THE JOURNAL

of the

The Convention Number

Vol. VI May 1921 No. 2

SUSTAINING MEMBERS

Western Canada Flour Mills Co.	Winnipeg, Man., Can.
Gooch Milling & Elev. Co.	Lincoln, Nebr.
Wichita Milling and Elev. Co.	Wichita Falls, Tex.
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Campbell System, Inc.	Kansas City, Mo.
Kansas Milling Co.	Wichita, Ks.
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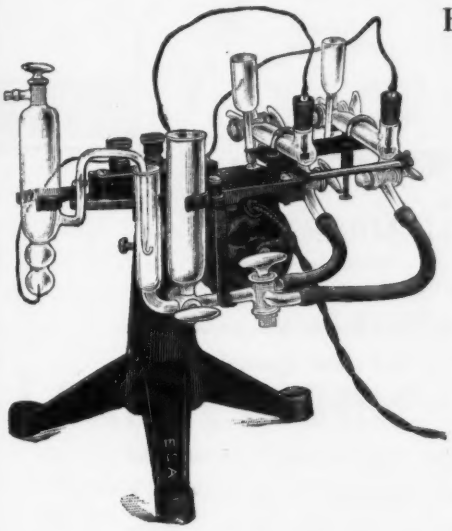
The sustaining members of this orggnization are milling companies and other organizations which have the interest of the cereal chemist and cereal chemistry at heart and wish to give them financial aid.

To increase the knowledge in cereal chemistry and to establish uniform methods of procedure and control of value to their employer.

Any information in regard to sustaining membership may be obtained from the secretary, Mr. C. J. Patterson, The Campbell System, Inc., Kansas City, Mo.

The sustaining member has all the rights of a member except the vote.



HYDROGEN ION APPARATUS

HYDROGEN ION APPARATUS

and other forms of electric testing apparatus. Electric testing is coming more and more into use in up-to-date flour laboratories. Be sides the regular hydrogen ion apparatus as indicated in the above cut, we supply the standard L&N potentiometer K, also the less expensive student potentiometer and other forms. We furnish also Eppley standard cells. Eppley electric titration appartus: Bailey and Hildebrandt hydrogen electrodes; Galvenometers; Freas, Jones Cantor, Washburn and other conductivity cells.

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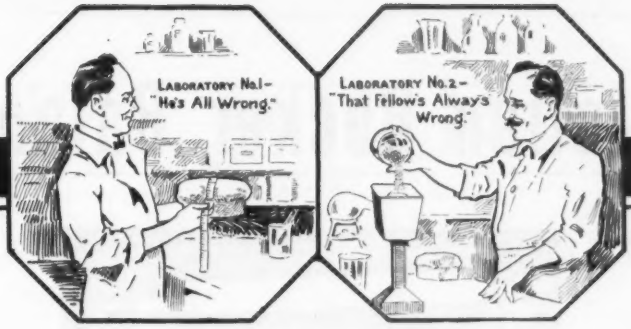
In the opinion of the editor, the Journal of our association is the mouth-piece of the Americmn Association of Cereal Chemists. We must make our Journal a value to the members and to every one who receives it.

In order to entlarge the Journal and increase the number published, it will be necessary for us to obtain a larger membership. It should be your duty, in fact, make it your duty to get as many members as possible. Your employer can be a sustaining member, and your friend, the chemist, can be an active member. Get them both. We need their support and knowledge, and in order to further our kwowledge of cereal chemistry we must work together. **All Together.** Not just a few of us as at present. Let ns get members so we can publish the best and the latest information along our chosen line of chemistry. So we can put out a Journal that our employer can read with interest, and profit by reading. A journal from which our fellow chemist can get the latest work that has been done in cereal chemistry, and taking in the larger field, milling chemistry.



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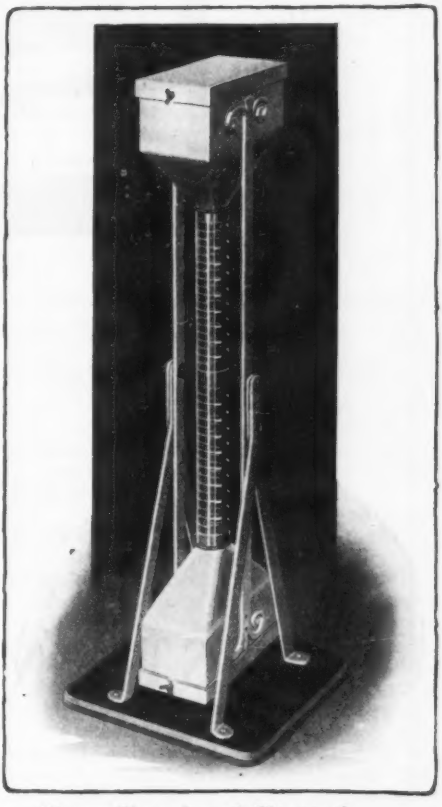

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THE JOURNAL

OF THE

AMERICAN ASSOCIATION

OF

CEREAL CHEMISTS

Published by the American Association of Cereal Chemists

VOL. VI *May 1921* *No.* 2

Editor ---------- J. R. Hess
Advertising Manager ---------- S. J. Lawellin

ANNUAL MEETING FOR THE YEAR 1921

At Kansas City, Mo. June 1, 2, 3, 4.

The annual meeting for 1921 will be held at Kansas City, Mo. on June 1, 2, 3, 4.

LET EVERY MEMBER BE PRESENT.

We will have one of the largest meetings in our history and every one of the members should be present. This is one of our most important meetings. The meeting will be held in the Coates house.

THE REASON

Editorial taken from the first Journal published by the American Association of Cereal Chemists and seems worthy of re-publication in the Journal at this time.

The Editor.

On the 8th of May, 1915, in Kansas City, Mo., a few chemists that were interested in cereal work met to form an organization for the advancement of the science as applied to cereal analysis. They were all operators in labratories in which the work was principally the control of flour milling operations.

In the course of their experience each one had been faced with the question, "Why can't you chemists agree on your reports?" It must be acknowledged that there are grounds for such queries, and that, tho they are explainable to the satisfaction of the chemists it does not eliminate the fact that it lowers the value of a chemical analysis in the eyes of the baker, jobber, or miller.

Each member present was there because he felt the need of associating with other chemists interested in the same lines of work, with whom he could exchange ideas and discuss the various methods as practiced by others. All realized that, if by means of discussion and investigation the best practicable method of procedure for each determination could be established, then standard methods could be outlined, and with that done, uniformity of results would follow.

This then is the object of the association which has taken onto itself the title of "THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS." To carefully consider methods of procedure and practice in cereal analysis by means of research and open discussion, and to draw conclusions which are representative of the convictions of the operators who are members. It is the desire to adopt methods which are as free of any scientific objections as possible but at the same time lend themselves to the best advantage under the conditions that exist in the ordinary "control" or "commercial" labratory. It is realized that there are many objections to be met each time that a standard method is

adopted. There will be special reasons why certain points in any method should be done slightly differently by different operators. All points that have a bearing on the results gotten by any method must be carefully considered and then the method that is the most scientifically exact and at the same time practicable, selected as the standard.

Every earnest chemist who is seeking to give his employer value received, will see in this movement an opportunity to increase his efficiency by joining with the members and giving and receiving in the efforts to achieve more uniform results. Flour and cereal chemistry has, in the past, never seen any concerted efforts put forth for its benefit and now when the start has been made it would be a great boon to all if the interested ones would come forward and join in the united membership in the interest of a worthy cause.

It is the earnest desire that millers and mill owner will understand the object of this organization. STANDARDS, is a word that has recently come into bad repute with many millers. We hope that such persons will not let the word deter them from reading the purpose and the ends to be accomplished by our body.

There is no intention of comparing milling methods or telling others the little things about our particular mill that puts it ahead of the other fellow. We will leave that to the millers themselves. The fact is that there are in almost all cases several ways to get the analytical data that makes the labratory valuable. Because of the differing methods there is a greater liability of apparent discrepencies in the work of different operators working under different conditions. Then again there is a grevious lack of system in the manner of reporting the data. For instance, three labratories might get the same loaf volume, and yet their reports would be utterly dissimilar, due to the fact that one reported in percentage, the second in cubic inches, and the third in cubic centimeters. Uniformity in this matter will only come thru some such agency as our organization proposes to be.

Another thing; we wish to assure the mill owners that there is nothing of the character of a "UNION" in this movement. This is a movement for the good of the profession in that it will increase the efficiency of the individual and in so doing, increase his value to the employer. A wage scale is the last thing that the ambitious operator would care to have to contend with.

THE FLOUR MILL CHEMIST

The flour mill chemist as a rule, is not satisfied to merely run the routine analysis of the mill. His outlook for a success in the industry must include a shortening of methods and in enlarging the cope of his work. He is not giving all he knows to the betterment of the industry, and he knows it.

All industries, in which a chemist is employed, his aim is to make more economical the processes and enable his plant to manufacture a quality product at less cost that his competitor. The flour mill chemist strives to do this by maining uniform quality.

At present we try to blend the wheat of given protein and kind, according to government standards, then mill, and pray for the resulting flour to be uniform. To see how accurate our guess has been, we test for ash, protein and bake.

The mill manager does not realize that in his chemist he has a man who has had the training, and should have the ability, and probably has, both the knowledge and ability to solve the problems of his mill.

What would the directors or owners of his company do, if he spent all his time doing routine office work? What he is paid for is to use his brain and think, which is harder work than the manual labor, and much more productive of dividends. If it wasn't, he wouldn't hold his job. Yet, he loads the chemist down with routine, which is necessary however, and also expects him to solve his problems.

How can the chemist be expected to work continuously at routine all day, and then solve problems? In his work, which is the most important, his analysis of products or the controlling of the raw materials of which the product is made. In my opinion, the place to control your product, is in the raw materials. In most mill laboratories, about nine-tenths of the time is spent on the routine of the finished goods.

Far more work should be done on the wheat. The miller should know what quality of flour to expect from the wheat. Not all wheats are alike, as we all know, in sugar content etc. The chemist should be able to test his wheat as received, and before it ever gets into the milling bins, he should

know how the flour from that wheat will test. At present our knowledge is limited in regard to the absolute value of a wheat as a quality flour producer. (Except by a long experimental mill work, which is too much of a time consumer to be used as a routine test in the small flour mill laboratory.

Most mills of 1000 to 2000 barrel capicity employ only one chemist, although I have heard of as many as ten being employed in a mill of 1800 barrel capacity. One chemist, in all probability, can handle all the routine in mills between 1000 to 2000 barrel capacity, but he will have no time to make out a comprehensive report A report that just consists of a row of figures, and does not correlate the results, and draw conclusions as to the meanings of the results, has lost 60% of its value. The reports should contain a very thorough interpretation of the results of analysis in terms lacking the technical terms of the chemist. In other words, the miil manager is not a chemist, and the results of the analysis should be explained and interpeted by suitable remarks. In order to do this, the chemist must have time to study the report. This is what most of us lack--time.

For instance, does a high ash indicate necessarily, poor milling? No. Because the wheat may naturally contain more ash per unit weight. For example: In a mill mix that run the same test weight, the ash on the wheat on two particular days, varied from 1.97% to 1.77%. That is .2% difference. The ash on the patent varied from .378% to .416% and the ash on the clear run from.488% to .546% on the above extremes in ash content of wheat. Was the increased ash on the products due to the milling or the wheat used? In all probability, both had some effect, for the miller cannot mill exactly the same from day to day on account of variations in humidity and temperature. But, unless the chemist has time to correlate his results of analysis, the blame might be placed wholly upon the miller.

The chemist must have more time in order to give his full value to his work. He must either have an assistant to do the routine work, or shorten the amount of work done, or use shorter methods. At present his only recourse is to obtain an assistant if possible. It is not desirable to decrease the present volume of the report, for it is already too small. The only other course lying open, is to shorten the methods used. This can be done only by research, and there is our time factor blocking us again.

So, if the miller is to get full value from his chemist, he must furnish an assistant, and if he does not, he can hardly expect anything else but the usual routine from his laboratory.

EXPERIMENTAL MILLING

The experimental mill is one of the ways tried to get the quality of flour made from the wheat as received. In my mind, the difficulties encountered in this work are three in number.

First—Lack of experience in the chemist miller.

Second—Time consumed in getting results.

Third—Difficulty of obtaining results that compare in any way to the work done on the large mill.

As a rule the chemist cannot devote but very little time to this work, and he has to do it more as a side issue. The chemist miller must devote considerable time and study to in any way get results that will give him the desired information.

Some comparative data on experimental milling, and actual large mill milling on same wheat are necessary. This, as a rule is not done.

The time required to temper properly and mill, is usually too long. By the time results are tabulated and conclusions drawn, the wheat has gone to the mill to be ground.

You cannot, to my mind, run experimental millings and run the bake only on the resulting flour, and get anything that really tells you anything. The flour must be tested as thoroughly as the resulting flour from the big mill, or more thoroughly to give the proper information.

If, as often happens where the experimental mill is used, all the cars of wheat received are milled, and a bake and washed gluten determined to give quality of gluten and loaf, the time conumed is considerable, and then not enough information is secured. The gluten quality may be excellent, but some other faction may affect the bake, and the loaf show up poor. Should the wheat be condemned if it does not bake well? It may, when properly blended, give an excellent bake. There are so many factions that effect the baking quality of the flour that it is hard to say whether the wheat should be used or

not. Soluble sugar content is one faction, soluble phosphates another, acidity and soluble protein, and in other words the total solubles has a far reaching effect.

In a recent experience with the experimental mill, when a wheat analized proper amount of gluten, and quality seemed correct, the bake was not always good. The manager blamed the baker. Was the the baker to blame? So many things can affect a bake. As previously mentioned, lack of time prevented proper tests being made to find the trouble. The entire conclusion had to be placed on the bake as to the blending quality of a wheat. I think that experimental mill chemists will agree with me in this, that the case often happens that two flours from two different wheats will bake very poor by themselves, but when blended will give a good loaf.

In experimental milling the milling should be done by an experienced man, and results compared with the actual large mill on same mix. The proceedure thus found to give best results should be adhered to. The comparison factor should cover the different test weights, grades and kinds, for size of berry will effect your results from both the experimental mill and the large mill.

You cannot grind the same on a 54lb. wheat that is a small sriveled wheat and a 54 lb. wheat that is composed of some shriveled and some rounded berry, and a 60 lb. wheat that is all the same size (approx.) and one containing large and small plump, well filled berries. In other words your procedure must be different on these to get best yields for each. In your actual mill practice you mill a blend that contains yellow berries hard flinty berries, small shriveled and large plump berries. The miller determines how to grind this mix to give best results all around. In doing this he mills some berries too close, and others not enough, but an average milling is what he must get. So your experimental milling will not actually give the results you will get on the large mill. But, you can approximate the results by grinding under same conditions in all cases, and calculating from that, your results in milling.

By the bake, the wheat flours that are not up to the standard must be tested to see what is wrong. And by proper reasoning, the lack or excess, as the case may be of any ingredient made up by blending and then if not able to remedy in this manner, condemn.

The experimental mill is the best method of obtaining an accurate knowledge of your wheat, if you have time, and a man who knows how to do it right. But, more tests than is the general practice now, should be made on the finished product to give information of value.

RESEARCH

The flour mill owners are surely as progressive as the baking shop owners or the laundry owners. The millers could form an organization or association as other industries have done, and have some comprehensive research done.

The individual flour mill firms are too small to support a research laboratory, but the combination with very little expense to the individual members could carry on some research through some institution like the Mellon Institute, where library facilities are the best, and the environment the best for intensive research. In this way some of the chemical problems of the milling industry could be solved.

We should know what quality of flour to expect from a given wheat, and by some tests that are applicable to the mill laboratory, be able to determine this. At present we have no test that fills this want completely, and the only method of getting this result is by research.

Chemistry is an experimental science, and the problems can be solved by experiment. The routine chemist in the flour mill is too busy to accomplish anything by research. Because it requires a mind that is free from the worries of routine analysis, and free to concentrate on the problem. In other words get a competent man and pay him enough salary to release him of financial worry, so he can concentrate his whole energies to solving the problems presented.

One of the many troubles to hinder the mill chemist from doing this when the mill is down is shortness of time. He may start out on a line of research, and just get good and started when the mill starts up again. It is put aside and by the time he is at leisure again he has to begin all over because of the interuption. Therefore his accomplishments in research are infinitessimal. It is time that the flour mills get some real research done, and the method herein mentioned is really the only way to get it. Think it over.

THE MELLON INSTITUTE OF INDUSTRIAL RESEARCH

The Mellon Institute of Industrial Research of the University of Pittsburg was founded by Dr. Robert Kennedy Duncan, and established on a permanent basis by the donations of Andrew W. Mellon and Richard B. Mellon.

"Individuals, corporations, and trade organizations, support at this institution, industrial chemists whose work consists of solving the problems of practical value to the interests supporting them. The institute supplies a plant and facilities, selects the qualified investigator and gives to the work of the investigator, such guidance and supervision as shall be productive of results of the maximum practical value. The relation between the institute and the individual or corporation or trade organization, is of contractual character, whereby the latter termed a donor, contributes to the Mellon Institute, a definite amount of money for a period of not less than one year, which must be adequate (1) to pay the investigators compensation and (2) for all necessary apparatus or equipment. This constitutes the creation of an industrial fellowship by the donor.

The nature of the problems whose solution is desired, or the investigative work which it is desired to have undertaken, as well as the qualifications of the investigator himself, are matters of discussion, and agreement between the officers of the institute and the donor. The Mellon Institute at the present time provides facilities and direction for the support of 35 individual and 12 corporate fellowships, covering, e. g., such subjects as aluminum, coffee, food containers, asbestos, toilet articles, synthetic reins, bread, enameling, leather belting, protected metals, collars, sulphur, dental products, copper, physiological reseach, quartz, oil, glass, gas, yeast, illuminating gas, glycerin, fibre, household utilities, zirconium, fish products, silicate, fuel, silverware, magnesia, insecticides, organic solvents, coke, fertilizer, glue, metalware, distillation, fruit beverages, soap, laundry practice, and refractories.

The sums devoted to the fellowships, the subject of many of which have just been enumerated range from $2,250 a year with a percentage of the gross profits of the application of the results of the investigation to $41,000 a year, determined in amount by the character of the work, and the number of men required in its prosecution. The usual sum required for establishments of an industrial fellowship appears to run around from $5,000—$6,000 a year.

The knowledge required by the investigator, is the property of the donor.

The Mellon Institute is in no sense a commercial enterprise, but exists solely to make science serve the practical needs of industry."

The above is quoted from the Chemial Age, March, 1921.

A METHOD FOR DETERMINING THE RELATIVE MERITS OF FLOURS

Used by the U. S. Army Quartermster, Chicago, Ill.

The Depot has taken the following method and will assign arbitrary multipliers to the results of analysis as follows, in order to obtain the relative rating of merit for each flour.

Absorption multiplied by 2; Vol. of loaf by 3; Color of flour by 4; color of bread by 4; flavor by 2; texture by 3; odor hot by 2; gluten content by 3; and subtract from the total summation of these products by the amount of ash.

The resulting figure will represent the relative order of merits of the flour submitted.

To take a concrete example:

Assuming that the analysis of the Flour shows: Absorption of 293; Volume of Loaf 79½; Color of flour 9; color of bread 9; flavor 9; texture 9; Odor hot 9; Gluten content 11½; and the ash of 56. We would have the following result:

203	x	2	equals	406.
79½	x	3	equals	238.5
9	x	4	equals	36.
9	x	4	equals	36.
9	x	2	equals	18.
9	x	3	equals	27.
9	x	2	equals	18.
11½	x	3	equals	34.5
Total				814.
Subtract Ash				.56
Rel. Merit of Fl.				813.44

The Depot will doubtless fix a definite figure of merit, say 800, and any flour equalling or passing that figure will be considered acceptable, and the award will doubtlessly go to the one showing relatively highest figure of merit at lowest price. This is as fair a method

of determining a reward as could possibly be arrived at, and the result should be satisfactory to all competitors.

(They have determined that hereafter that they would not take flour that had an absorption of less than 20 cc of water to 34 grams of flour, or an ash exceeding .5).

RESULTS OF ANALYSIS

Why do the results of analysis obtained by the miller from the commercial laboratories not check with those obtained from our flour mill laboratories ?

This is a serious but nevertheless true complaint by the miller against the commercial laboratories and the flour mill chemist. But there is no reasonable excuse for not checking; for example, on the ash determination. In some recent flour sent out by a certain mill the flour was shipped and complaint was entered. Samples were sent to a large baking company's laboratory and returned to the mill and another sample sent to a commercial laboratory. The mill laboratory got .414 and the bakers laboratory .410, the commercial laboratory .47 all on the same sample. **Who was right?** Another example was from the mill .460 return to same laboratory .470 and commercial laboratory .44. Again who was right? A difference of 3 to 6 points is the difference between a patent or 95% straight or a patent and 100% straight.

Now the commercial laboratory in a controversy like those sighted above should at least state the method used in the determination. In fact the method should always be given in any case. A uniform method or determining ash can certainly be devised.

Protein determination seemed fairly constant. In the acidity soluable corbohydrates, and total soluable determinations the method used should by all means be given.

ABSORPTION

Recently a sales manager complained to the editor that the absorption given to the salesman by the chemist would not hold good in actual baking practice. As he had recently told a flour buyer that his flour was giving 60% absorption on the fresh flour from the mill. The baker flour buyer replied that it would mean about 58% in the bakery. That the flour mill chemist was always giving too high results for absorption.

The chemist in the flour mill gives as a rule the absolute total absorption neccessary to give a dough of a certain consistancy. He is right. The baker in these cases does not take in account the moisture in the ingredients he adds, ,vis; malt, condenseo milk, etc. If he does he is probably using a liquid fat or oil for shortening and that would lower his water absorption. In discussing with a buyer the absorption the salesman should remember these points.

UNIFORM BAKING FORMULA

In looking through the files of the Journal, the discussion of a uniform baking formula, has been much the most prominent of all discussions, but nothing definite seems to have been accomplished.

Formulae of different proportions of materials has been proposed, and some approved, but no particular formula seems to have been adopted officially.

The following are some of the formulae proposed.

Mr. C. J. Patterson suggested the formula in this journal Vol. I, 2 in May 1916, page 4, and seems to have obtained the approval of the association.

Flour	392.	Grams
Sugar	7.	Grams
Salt	5.	Grams
Yeast	5.	Grams
Lard	5.5	Grams

Fermentation period to be between four and five and one-half hours, with thirty minutes proof.

Mr. H. B. Kepner in Vol. I, 2, May 1916, Page 14, proposes a formula on the basis of one hundred pounds of flour. Using one and one-half percent salt and one percent yeast. First turn 2½ to 3½ hours; second turn 1 to 1½ hours; third turn ½ to 1 hour; bench ½ hour; proof in pans, about 45 minutes. By using 2% yeast the time of the dough is decreased a little less than ½.

Then Mr. Hogan proposes in this journal, Vol. I, 2, 16.

Flour	600	Grams
Sugar	12	Grams
Salt	10	Grams
Yeast	12	Grams
Lard or Oil	12	Grams

Mr. Patterson again mentioned a

standard baking formula in our last meeting May 1920, but nothing seems to have been decided definitely.

Let us get together on this subject and look at it from a scientific view point. We can surely decide on the quantity of flour to be used, to conform with baking practice. Total sugars necessary to properly ferment the dough, and give color crust desired. Salt in sufficient quantity to give flavor and yet not unduly retard fermentation. Yeast in sufficient quantity to give proper fermentation within time limits desired, and shortening for flavor and keeping quality. Shortening also effects texture and the crumb. It seems that something definite should be decided on this very important subject.

Don't we try to make a good loaf of bread from our flour, regardless of the quality of the flour? In my opinion we should, by all means, adopt a uniform baking formula, and adhere to it. Not give the best formula for a particular flour, but adapt our flour to the standard baking formula, and keep it up to that standard. If your flour does not give a good loaf, under the conditions of the standard formula find out what it lacks and remedy it in the flour, don't change your baking formula to conform with the flour. Prove to your mill manager or miller, that the flour lacks some quality that can be put into it by proper blending or milling. If it can be remedied by blending, show the mill manager or wheat buyer what is needed. You can prove it to him by the baking test. If it is in the milling, don't atempt to tell the miller his business, but talk it over with him, and get him to suggest what might be wrong in his method of milling. As a rule, I think you will find that the miller will know what is needed, and if it is in the mill.

By all means let us adopt a scientific, uniform baking formula.

THE CHEMIST

(By C. J. Patterson)

The progress of the present day chemist is growing very rapidly. He is coming from behind the screen of seeming worthlessness, from an industrial standpoint, to a position of inestimable value. This condition is being brought about by the chemist's ability to commercialize his knowledge, to isomerize theory and practice in accomplishing industrial efficiency.

This leads us to the undetermined value of a chemist, and brings to mind, "THE PRICE OF A CHEMIST."

I am firmly convinced of the inadequate compensation of the average chemist. I am not firmly convinced that this condition is entirely the fault of the employer. It is necessary for a man to be a successful salesman, to first sell the selected product to himself; to cause an isomeric condition to exist. For the chemist to be a success, he must sell himself to his employer by applying his knowledge in such a way as to produce a better finished product, more efficiently.

I think vision is a big word for the chemist, for he must create an industrial vision in order to produce more efficiently. He must also have the ability to visualize the commercial possibilities of a theoretical idea. In this way, the price of a chemist can reach its just level. In "Essay On Man." by Thomas Hobbe, a vision will be found that is applicable to men in every phase of life.

> "The value or worth of a man, is, as all other things, his price; that is to say, so much as would be given for the use of his power, and, therefore, is not absolute, but a thing dependent on the need and judgment of another. An able conductor of soldiers is of great price in time of war, present ,or imminent, but in peace, not so. A learned and uncorrupt judge is worth much in time of peace but not so much in war, and as in other things, so in men—not the seller, but the buyer, determines the price. For, let a man, as most men do, rate himself at the highest value he can, yet his true value is no more than it is esteemed by others.

It seems well for the cereal chemist to visualize his position and make untiring effort to sell himself to his employer. There are many problems in the flour mill and bakery, that if perfected, would accomplish such a sale. The chemist in the mill has not an absolute method for determining the baking value of the flour. The baking chemist, at present, is in the same position.

A flour is purchased by the Campbell Baking Company, if the flour produces a loaf equal in every respect to our standard loaf, within a given fermen-

tation period, with an additional requirement that the flour must be of good color and well dressed and not have more than 13% of moisture at our plant.

It is my desire to see much more energy and research by members of the A. A. C. C. in the future, which must be, if the price of a cereal chemist is to be determined.

WHAT IS YEAST?

(By Dr. Everett Lee of The Fleischmann Co.)

Fleischmann's Yeast is the name applied to the saccharomyces cerivisiae when manufactured and sold in bulk. Botanically the term "Yeast" is confined to oval or round microscopic unicellular fungi which multiply by budding.

Fleischmann's Yeast is a special variety of the S. Cereivisiae selected for and cultivated to develop, extreme hardiness, resistance of bacterial infection and high fermenting power.

It never forms mycelia but under certain abnormal conditions, while its cells may elongate they never show the complexity of a typical mycelium. Sporulation occurs in the absence of food.

While yeast or leaven has been known and used from the very earliest times, individual yeast cells were not seen till Leevehoek developed the first crude microscope in 1680. Their real significance was established by Pasteur in 1859.

Under a magnification of six or seven hundred yeast presents the appearance of semi-transparent slightly granular globules. They are round or slightly oval and have a diameter of about seven microns (1-4000 1-3600 inches) which is about the same as a human red blood corpuscle. With higher magnification a very thin membrane may be detected. Many of the cells contain one or more sharply defined, clear areas which indicate cavities enclosing liquid known as vacuoles. Occasionally small particles exhibiting Brownian movement may be seen within the vacuoles. The nucleus, an oval shaped body, usually close to the vacuole is invisible without special staining. The protoplasm of young cells is clear. The mature cells show slight granulation, which increases with age.

If the yeast cell are suspended in a nutrient solution such as grain extract the process of reproduction and growth may be readily observed.

A single yeast plant after a latent period of fifteen or twenty minutes shows a slight projection one side. This projection or bud grows till it is nearly as large as the original plant. Then it too puts out a bud and before this is full grown the first plant or mother cell puts out another bud, and this process continues until twelve or fifteen cells are formed. Then the ripening out process occurs when all these seperate one from another and float about singly.

This completes the life cycle of the yeast plant and now each cell is ready to repeat the process if sufficient food is present.

A cake of Fleischmann's Yeast consits of millions upon millions of these cells pressed together in a solid mass.

For the healthy growth of yeast the media should contain nitrogenous material in diffusible form—a fermentable sugar such as sucrose, maltose, glucose or fructose, and a sufficient quantity of the necessary mineral matter which should contain potassium, magnesium, calcium, iron phosphorus and sulphur. These constituents should bear a definite quantitative relation to one another and a proper concentration must be maintained .

The manufacture of compressed yeast is not a simple process. Yeast must be grown uniformly day in and day out in spite of variations in the weather and the quality of the grain avialable.

Corn, malt, rye and malt sprouts supply the food material in which the yeast is grown.

Starting with the finest selected materials, the procedure is briefly as follows.

The corn after cleaning and grinding is cooked with water, under steam pressure, to rupture the starch granules so they can be acted upon by the diastase of the malt. It is then dropped into the mash tub shown below the cooker. Here the cleaned ground malt is added and held at the proper temperature till all the starch has been converted into the sugar known as maltose.

The other grains shown on the diagram are now added, thoroughly mixed, and the whole, called the mash, is pumped to the souring tub.

Yeast grows best in a slightly acid solution. The necessary acidity is obtained by seeding the warm mash with a pure culture of another microscopic plant known as the lactic acid bacillus. By the growth of this organism the mash is soured, purified and valuable food material extracted from the grain.

At the end of eighteen hours the mash is sterilized and pumped to the filter tub.

The grain extract, containing all the nutritive matter, is next filtered into the large bright copper fermenters. It is seeded with a pure culture of yeast,, air is blown through to supply the necessary oxygen, and the yeast is allowed to grow for about eighteen hours. The greater part of the liquid is then separated by centrifugal separators and the yeast removed from the remainder by pressing dry in multiple plate filter presses. z z

It is then mixed to insure uniformity, cut into pounds and delivered to the baker.

The entire operation from start to finish requires the utmost care and supervision. The temperatures throughout are accurately controlled and frequent samples taken for analysis. Absolute cleanliness must prevail to produce a yeast with the highest keeping qualities.

Few bakers realize the amount of care, thought and personal attention that is necessary to produce a pound of yeast, nor do they appreciate the wonderful organization that has been perfected, which enables us to deliver yeast promptly and without fail to every part of the United States.

A visit to one of the Fleischmann factories, where this whole process may be seen, is a revelation in scientific management.

Fermentation in its broadest sense includes all these chemical changes which are brought about by ferments or enzymes. By yeast fermentation is meant the conversion of sugar into alcohol and carbon dioxide. All the common monosaccharids, such as dextrose, levulose and mannose are fermentable. Of the disaccharids, cane sugar and maltose are readily fermentable but lactose or milk sugar is not fermentable by bakers' yeast.

Buchner has shown that monosaccharids are readily converted into alcohol and carbon dioxide gas by the liquid which can be extracted from yeast by combined grinding and pressure. The activity is due to an organic compound, an enzyme, known as Zymas.

1:—Buchner-Berichte 1. Cent. Chem. Gesell. 30,118; 34, 1523, etc.

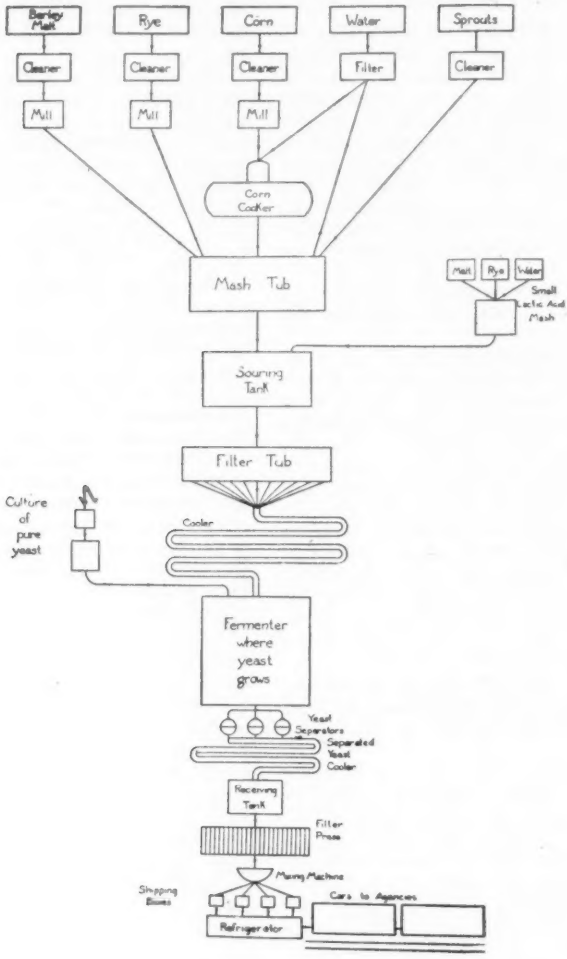
None of the enzymes have been isolated in a pure state and their composition is unknown. Zymase is very unstable and is probably destroyed by the endotryptase, a proteolytic enzyme which is extracted with it.

Disaccharids such as cane sugar and maltose are not attacked by zymase. They must first be converted into monosaccharids by the enzymes invertase and maltase respectively.

In bread yeast serves the double purpose of producing gas from the sugar used and of ripening the gluten. To the yeast is chiefly due the delicious flavor of bread.

In the use of yeast in bread the baker should remember that he is not only using a leavening, agent but is also adding food value to the loaf. Yeast is also very rich in the water-soluble vitamine, so necessary for the maintenance of vigor and health, therefore forms a most important addition to the loaf from a nutritive standpoint. It is because of its high vitamine content that yeast possesses such remarkable curative properties, and makes it valuable for the maintenance of health.

Diagram of Yeast Manufacture



THE above diagram is known as a flow sheet of yeast manufacture, and illustrates the various processes necessary to produce a pound of yeast.

THE RELATION OF ASH AND GLUTEN IN WHEAT FLOUR

(By H. E. Weaver)

Expressing the percentage of ash in flour is in reality giving the percentage of mineral matter contained therein.

The ash is composed principally of the following chemical compounds: silica, allumina, ferric, oxide, potash, lime, magnesia, phosphoric acid, sulphur trioxide, zinc oxide, and some times a little soda and a trace of chlorin. The potash, lime, and phosphoric acid form about ninety (90) percent of the total ash. These salts are needed for the upbuilding of the bone and tissue of the human body. The presence of these salts lend stability to the gluten, and in the case of the phosphoric acid and probably also the potash acts as food for the yeast during fermentation.

Considerating these facts, some have claimed the higher the ash, the more valuable the flour is as a food, and the better the fermentation of the dough. It is true the body should not be compelled to depend upon the salts alone, nor does it. The value of the salts contained in the ash as a yeast food is doubted, but large quntities are not necessary to perform this function. Good healthy fermentation is obtained every day using flour with an ash content as low as .37 of one percent.

The ash is, of course, contained in wheat, and, contrary to the popular belief, is contained throughout the wheat berry, and not all around the bran coating The wheat berry is divided into three parts: the bran coating, the germ, and the endosperm,m each with its own peculiar function. The bran coating is for the protection of the berry: the germ is the embryo wheat plant, and its function is reproduction, and the endosperm is the part stored with starch and gluten, and is for the purpose of feeding he young plant until it can take root and take its nourishment from the soil. The endosperm is separated from the bran and germ during the process of milling, and is used for flour. Ash is contained in all these parts; the subjoined table of analysis of mill streams will give some indication as to the baking qualities of the flour, and the distribution of the gluten.

	1st Crush Coarse	2nd Crush Coarse	3rd Crush Coarse	4th Crush Coarse	5th Crush Coarse	6th Crush Coarse	7th Crush Coarse
Ash	.33	.34	.38	.39	.45	.54	.72
Gluten	11.55	11.73	12.07	12.07	12.68	13.07	13.21
Vol of Loaf	154.	152.	100.	100.	98.	97	96.
Color of Bread	99.	99.	160.	160.	170.	162.	146.
Bloom	Ex.	Ex.	Ex.	Ex.	Good	Fair	Poor

	1st Crush Fine	2nd Crush Fine	3rd Crush Fine	6th Crush Fine	5th Crush Fine	4th Crush Fine	7th Crush Fine
Ash	.35	.37	.40	.45	.44	.61	.60
Gluten	11.81	11.81	11.81	12.55	11.98	12.42	14.21
Color of Bread	100.	100.	99.	.98.	98.	97.	96.
Vol of Loaf	.158	154.	152.	172.	160.	150.	156.
Bloom	Ex.	Ex.	Ex.	Good	Good	Fair	Fair

	1st Break	2nd Break	3rd Break	4th Break	5th No. 1	Break No.2
Ash	.54	.41	.48	.64	.73	.96
Gluten	10.32	10.42	13.42	15.21	16.21	16.88
Color of Bread	96.	98.	99.	90.	50.	50.
Vol of Loaf	156.	156.	178.	140.	96.	85.
Bloom	Poor	Fair	Good	Poor	Poor	Poor

	1st Sizing	2nd Sizing	3rd Sizing
Ash	.44	.42	.58
Gluten	11.91	11.37	11.55
Color of Bread	99.	100.	98.
Vol of LoafL	152.	152.	148.
Bloom	Fair	Good	Poor

	Germ Tail	Course Tail	Fine Tail
Ash	.67	.92	.95
Gluten	12.02	13.30	16.08
Color of Bread	94.	87.	83.
Vol of LoafL	158.	148.	144.
Bloom	Poor	Poor	Poor

	1st Finish No. 1	1st Finish No.2	1st Finish No. 1	2nd Finish No. 2	3rd Finish
Ash	.92	.89	.63	.68	.75
Gluten	15.60	14.50	15.00	12.60	13.30
Color of Bread	85.	85.	88	87.	86.
Vol of Bread	140.	144.	150.	148.	146.
Bloom	Poor	Poor	Poor	Poor	Poor

	Bran & Shorts No 1	Duster No 2
Ash	.82	.68
Gluten	14.00	12.60
Color of Bread	86.	87.
Vol of Loaf	144.	148.
Bloom	Poor	Poor

	Germ	Shorts	Bran	Wheat
Ash	7.82	2.21	6.26	1.85
Gluten	-----	-----	-----	-----
Color of Bread	-----	-----	-----	-----
Vol of Loaf	-----	-----	-----	-----
Bloom	-----	-----	-----	-----

About 80% of all flour is found in the crushes or middlings, which is composed of the best of the berry. A glance at the above table will show that the greater ash is contained near the bran coat. A little study of the crushes shows that the best bread is obtained from the streams lowest in ash, also the gluten increases in the crushes, as the ash increases. It is worth noticing also that the fine crush carries just a little more ash than the coarse. In the break flours, the relation between gluten and ash disappears. From the analysis of mill streams, one comes to the conclusion that the best and purest flour contains the least ash: this is true provided the streams are properly handled.

What is the value of the ash test? To the baker it is an indication to the grade of flour, but is not infallible, and should always be checked by other tests. It is probably a true indication nine times out of ten, but poor milling has more effect upon the ash content of flour than the percent of ash contained in the wheat. Wheat which lacks the proper conditioning in the way of tempering and heating is sure to make poor flour with a high ash content. While there is no doubt the best grade of any one mill will show a lower ash content than the lower grades of this particular mill,, it may be possible that some other mill through superior milling is making a better flour with as low or lower ash content, although the per cent patent is longer.

For example: One mill makes a patent with .48% ash, and another mill makes a straight with the same percentage. The straight in all probability is the better flour because it is clear and pure, its ash belongs there, but the patent contain from .06 to 10% of dirt and offal, due to poor milling.

The percent of ash is a good indication to the grade of flour, but is better checked by other tests. The baker who buys by the ash test alone, should take care to put a very low amount as his standard.

To the miller the ash test is of far greater importance. It is the best indication as to the uniform action of the mill day after day. As long as the ash contents run uniform, there is little doubt that the best flour is being made that the wheat mixture will permit. As soon as the ash runs high, it shows something is wrong, and quick investigation is in order; then an ash test of the various streams is made and the trouble located. Sometimes the trouble can be

traced directly to some machine as in the following case, being an investigation after a slight increase in the ash content of the patent flour, the clear remaining normal.

1st Mids	.77
1st Mids—1st Cut	.39
1st Mids—2nd Cut	.46
1st Mids—3rd Cut	.71
2nd Mids	.54
2nd Mids—1st Cut	.41
2nd Mids—2nd Cut	.38
2nd Mids—3rd Cut	.43
2nd Mids—4th Cut	.94
3rd Mids	.42
3rd Mids— 1st Cut	.41
3rd Mids—2nd Cut	.45
3rd Mids—3rd Cut	.60

The last two tests show poor working purifiers, the test located the scource of the trouble and enabled the proper corrections to be made. As the rest of the purifiers were working nicely, the work done on them will not be shown here. For the miller, the ash test is a great aid toward keeping the flour uniform and locate the source of trouble.

There are several ways of determining the percentage of ash in flour. All involve the driving off of all matter except the mineral matter, by heat. The one with which the writer has had the most success is the "Muffle Furnace" method. This consists of heating a weighed quantity of flour in a muffle furnace, at low red heat, until it ceases to lose weight. When complete, the ash will be light and loose, free from carbon spots, and range in color from white to dark grey, depending upon the grade of the flour, the lower grades of flour being darker in color. This. test takes from six to ten hours in time.

The calcium acetate method is much quicker. This method consists in adding to a given quantity of flour a certain amount of calcium acetate solution. The weight of calcium oxide per cc of solution is of course previously determined. The solution of calcium acetate is mixed thoroughly with the flour in a platinum crucible heated until dry over a flame then finished in the muffle furnace. The weight of the calcium oxide added is of course deducted from the final weighing.

This method usually gives low results, although there is danger that the solution made up will not remain uniform, and the test made with the last of the solution will give higher results. An ash which has been over heated and become fused, will be greatly benefited by the addition of a little nitric acid. During fusing the phosphates are reduced to metaphosphates, the addition of nitric acid tends to oxidize the metaphosphates to their former condition and restore the weight lost in the reduction. However, it seldom pays to work with a fused ash, and the, best plan is to discard it entirely.

The writer has made some investigations to determine if high gluten flours contain more ash than low gluten flours, with the following results. The flours here given are all milled from Kansas hard wheat, and are supposed to be of the same grade:

Sample No.	% Gluten	% Ash
No. 1	11.81	.36
No. 2	11.63	.35
No. 3	12.68	.35
No. 4	11.21	.38
No. 5	13.21	.37
No. 6	12.71	.42
No. 7	12.31	.40
No. 8	12.62	.37
No. 9	11.99	.42
No. 10	10.82	.42

There is nothing here to indicate that a high ash follows a high gluten. The conditioning of the wheat and the milling are in all probability, responsible for the variation in ash, and not the strength of the wheat mix used.

RELATION OF GRADE, CLASS, AND ORIGINATING POINT OF WHEAT TO VOLUME OF BREAD BAKED FROM FLOUR MADE THEREFROM

By Samuel J. Lawellin

In the February issue of this Journal were reported the average volume results of baking tests made on flour, which was obtained from wheat samples ground on a Wolf experimental mill. These experiments have been continued and the data obtained is offered for whatever value it may be.

Table III gives the averaged results as obtained on samples baked since the previous report and Table IV gives the combined results of Table II (February Issue) and Table III, and includes all samples so far baked from the 1920 crop. All saples were handled as indicated in previous report and both milling and baking experiments were carried out quite uniformly.

TABLE III

Section	Class	Grade	Average Samples	Volume Average
Minnesota	Dk. Spg.	No. 1	20	194
Minnesota	Dk. Spg.	No. 2	7	189
Minnesota	Dk. Spg.	No. 3	39	194
Minnesota	Dk. Spg.	No. 4	4	189
Minnesota	Dk. Spg.	No. 5	9	190
Minnesota	No. Spg.	No. 1	4	191
Minnesota	No. Spg.	No. 2	1	188
Minnesota	No. Spg.	No. 3	1	181
North Dakota	Dk. Spg.	No. 1	98	192
North Dakota	Dk. Spg.	No. 2	71	192
North Dakota	Dk. Spg.	No. 3	58	181
North Dakota	Dk. Spg.	No. 4	59	190
North Dakota	Dk. Spg.	No. 5	6	186
North Dakota	Hd. Win.	No. 1	2	172
South Dakota	Dk. Spg.	No. 1	15	192
South Dakota	Dk. Spg.	No. 2	2	198
South Dakota	Dk. Spg.	No. 3	9	195
South Dakota	Dk. Spg.	No. 4	42	191
South Dakota	Dk. Spg.	No. 5	56	194
Montana	Dk. Spg.	No. 1	46	193
Montana	Dk. Spg.	No. 2	20	196
Montana	Dk. Spg.	No. 3	5	202
Montana	Dk. Spg.	No. 4	3	180
Montana	Dk. Spg.	No. 5	1	206
Montana	Dk. Win	No. 1	66	181
Montana	Dk. Win	No. 2	12	182
Montana	Mixed	No. 1	3	190
Montana	Mixed	No. 2	1	192
Canada	Dk. Spg.	No. 1	6	189
Canada	Dk. Spg.	No. 2	2	182
Canada	Dk. Spg	No. 3	3	199
Canada	Dk. Spg.	No. 4	1	185
Canada	No. Sp	No. 1	9	192
Canada	No. Spg.	No. 3	1	192
Nebraska	Hd. Win.	No. 2	6	187
Southwestern	Hd. Win.	No. 1	5	190
Southwestern	Hd. Win.	No. 2	3	185
Total Samples Averaged			696	

By ranking the grades according to the average baking value as shown by volume, and expressing each numerically as volume rank, as compared to total average rank of 100, we get the following values:

No. 1 Wheat	82
No. 2 Wheat	80
No. 3 Wheat	86
No. 4 Wheat	44
No. 5 Wheat	76

This ranking value would show us that No. 3 wheat, as taken from the total classes and volumes averaged, shows the best strength for the samples in Table III, with No. 1 and No. 2 close seconds.

TABLE IV

Section	Class	Grade	Samples Average	Average Volume
Minnesota	Dk. Spg.	No. 2	20	194
Minnesota	Dk. Spg.	No. 2	7	189
Minnesota	Dk. Spg.	No. 3	46	192
Minnesota	Dk. Spg.	No. 4	8	185
Minnesota	Dk. Spg.	No. 5	19	185
Minnesota	No. Spg.	No. 1	4	191
Minnesota	No. Spg.	No. 2	1	188
Minnesota	No. Spg.	No. 3	4	169
Minnesota	No. Spg.	No. 4	20	163
Minnesota	No. Spg.	No. 5	2	169
Minnesota	Dk. Win.	No. 1	4	180
Minnesota	Dk. Win.	No. 2	5	176
North Dakota	Dk. Spg.	No. 1	98	192
North Dakota	Dk. Spg.	No. 2	96	191
North Dakota	Dk. Spg.	No. 3	79	190
North Dakota	Dk. Spg.	No. 4	75	189
North Dakota	Dk. Spg.	No. 5	9	185
North Dakota	Dk. Win.	No. 1	30	182
South Dakota	Dk. Spg.	No. 1	9	188
South Dakota	Dk. Spg.	No.2	4	190
South Dakota	Dk. Spg.	No. 3	20	185
South Dakota	Dk. Spg.	No. 4	66	187
South Dakota	Dk. Spg.	No. 5	81	194
Montana	Dk. Spg.	No. 1	46	193
Montana	Dk. Spg.	No. 2	20	196
Montana	Dk. Spg.	No. 3	5	202
Montana	Dk. Spg.	No. 4	3	180
Montana	Dk. Spg.	No. 5	1	206
Montana	Hd. Win.	No. 1	94	180
Montana	Hd. Win.	No. 2	26	186
Montana	Hd. Win	No. 3	6	188
Montana	Mixed	No. 1	3	190
Montana	Mixed	No. 2	1	192
Canada	Dk. Spg.	No. 1	6	189
Canada	Dk. Spg.	No. 2	2	182
Canada	Dk. Spg.	No. 3	3	199
Canada	Dk. Spg.	No. 4	1	185
Canada	No. Spg.	No. 1	17	190
Canada	No. Spg.	No. 3	1	192
Southwestern	Hd. Win.	No. 1	15	171
Southwestern	Hd. Win.	No. 2	20	171
Southwestern	Hd. Win.	No. 3	2	154
Nebraska	Hd. Win.	No. 1	29	166
Nebraska	Hd. Win.	No. 2	6	187
	Total Samples		994	

By ranking the grades in Table IV we get the fllowing results:

No. 1 Wheat	82
No. 2 Wheat	76
No. 3 Wheat	73
No. 4 Wheat	40
No. 5 Wheat	64

This would almost reverse the rank of Table III and give first place to No. 1 wheat. On account of greater number of samples averaged in Table IV this would really show the better average for the years crop.

Individual high rank for the crop would apparently go to No. 5 Montana spring wheat with a volume of 206. However, only one sample of this class and grade has been secured, which would hardly be enough to give a fair average. Observations of the baking tests from day to day show very well that the best wheats for the 1920 crop are North Dakota, Montana, and Canadian of the grades No. 1, No. 2, and No. 3.

As regards strength there is a slight advantage for No. 3 wheat, followed by No. 2, and then No. 1. However, it was quite natural to find that the color and yield of the wheat was best in No. 1, followed by No. 2 and then No. 3. All things taken into consideration it was evident that the ranking for wheats of the 1920 crop would be in the order, No. 3, No. 2, No. 1, No. 5, and No. 4. As far as locality is concerned they would be ranked as from Western North Dakota, Central Montana, and Manitoba.

Acknowledgement is made to Miss K. F. E. Gleason for conducting the baking experiments and the tabulation of data.

ALLIGATION

(By Dean Yohe)

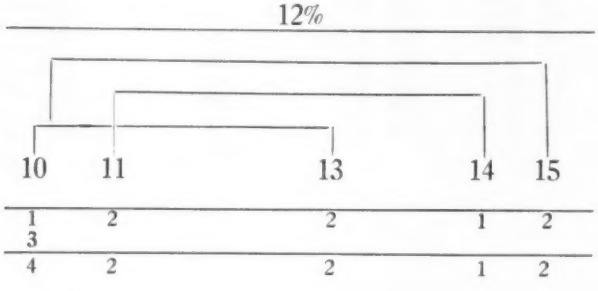
A method of ascertaining the quantities of substances of different percentages composition to be uesd to make a mixture of a definite composition in that respect.

There are a number of instances where the Cereal Chemist may use this method to advantage, as it does not require lengthy computation and the result when obtained is easily proven.

If it happens that wheat has been unloaded into bins according to Protein percent and a mixture for grinding is desired containing a certain proximate percent protein, or possibly in some instances wheat may be graded according to percent moisture and a certain mix is desired for grinding in order that the water used in tempering will be within a certain degree of variation.

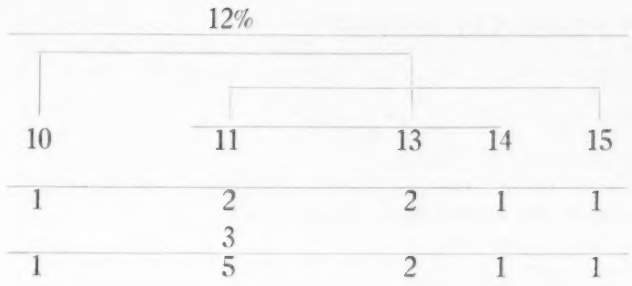
In case a grinding mixture of 12% protein is desired and there are two bins containing 10% and 13%. One part of the 10% is needed for two parts of the 13%. But if there are four, six or eight bins to be used from, the solution is not so direct.

Rule: Write the percentages in a horizontal row: connect with a line each percentage which is greater, than that sought, with one that is less, and each one that is less than that sought, with one that is greater; then write the differences between the percentage of the mixture sought and that of each of the components under the percentage of the other component with which it is connected by a line. The figures thus placed under each percentage will represent the proportional part (by weight) of each component to be used. For example: Six bins contain 10, 11, 12, 13, 14 and 15% Protein respectfully and a mixture of 12% is desired. It is evident the bin with 12% may be used in any quantity or cut out entirely, but the remainder mixed as follows:



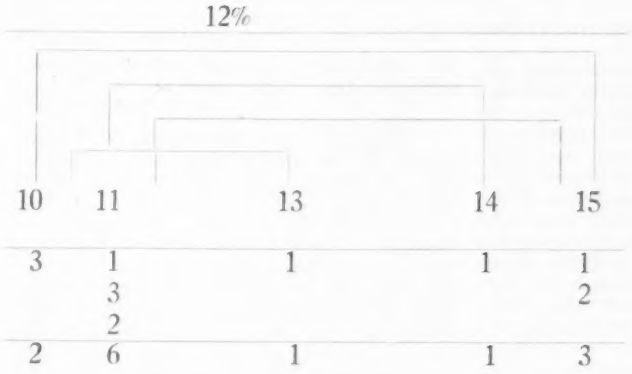
Proof

4 x 10	40
2 x 11	22
2 x 13	26
1 x 14	14
2 x 15	30
11	132
132 / 11	12



Proof

1 x 10	10
5 x 11	55
2 x 13	26
1x14	14
1 x 15	15
10	120
120	
10	12



Proof

3 x 10	30
6 x 11	66
1 x 13	13
1 x 14	14
3 x 15	45
14	168
168	
14	12

With a large number of components in question there will be an indefinite number of ratios. As in the above examples there are several ways of joining the greater and the less so that one or more components could be used in greater amounts or could be used rather sparingly. In this manner the chemist may be governed by other desirable qualities of flour as well as protein.

The same rule will apply to mixing liquids of different Specific Gravities, (providing there is no change in volume) as in the preparation of N-10 Sulphuric Acid. The Specific Gravity of N-10 Acid may be taken at any desired temperature and that of distilled water at the same temperature taken as unity. A sample is prepared too strong and its specific gravity taken. The calculation for dilution is similar to the preceeding case.

There are many other ordinary reagents which may be prepared in this manner.

NOTE ON FILTRATION WITH ALUNDUM CRUCIBLES

In filtration with alundum crucible with vacuum the more surface exposed to the suction the more rapid the filtration. In order to expose the maximum surface the various laboratory supply houses have gotten up rubber rings of different shapes and sizes to hold the crucibles while filtering. After using these rings for a few times they break or crack and cannot be used again because they will not hold the vacuum.

The following procedure has been tried and has given excellent service.

Take a porcelain gooch crucible with open bottom, that will hold the alundum crucible allowing about 1-16 inch all around at the top, and fit into the filter flask by means of rubber stopper cut with hole to fit the botom of gooch. Cut a piece of small thin walled rubber hose and splice, using an angle of about 30 degrees. Wrap as tightly as possible about the top of the alundum crucible maching the splice in the tubing. Put in place inside the gooch. The suction should be on when putting the alundum crucible in place, this will pull the joint air tight and after filtration the release of the suction will loosen or through the tubing out and the alundum crucible is easily removed. Solid rings were tried and the difficulty of releasing the alundum crucible after the operation was finished caused it to be discarded.

J. R. Hess

PERSONAL NOTES

Mr. R. Wallace Mitchell has severed his connection with The Campbell System Inc., and has accepted a position with the International Milling Company of New Prague, Minn.

Mr. H. T. Buchanan has accepted a position as chemist for The Texas Star Flouring Company, Galveston, Texas.

Mr. F. H. Loomis has accepted a position as chemist for the Interprovincial Flour Mills, Limited, Saskatoon, Sask., Canada.

The following abstracts were taken from the Chemical Abstracts and published in this Journal by permission of the Editor E. J. Crane.

NOTE:—

In all cases where the Greek letter *gamma* was used in the text, this letter was replaced by a √.

Some results of the determination of potash by the Lindo-Gladding method. H. C. MOORE AND R. D. CALDWELL. *J. Ind. Eng. Chem.* 12, 1188–9(1920).—Fertilizer chemists have known that K_2O results are lower if the K_2PtCl_6 ppt. is washed with 80% alc. than when 95% alc. is used. This has usually been attributed to the greater solvent action of the alc. upon the ppt. but the expts. here described show that the trouble is due to a solvent effect or caused by the NaCl present. The A. O. A. C. method should be corrected. W. T. H.

The influence of potassium permanganate on Kjeldahl nitrogen determinations. DONALD C. COCHRANE. *J. Ind. Eng. Chem.* 12, 1195–6(1920).—N detns. made without the use of $KMnO_4$ on feeding stuffs and on feces are less accurate and always lower than when this reagent is used, although the contrary has been suggested by Frear in 1905.

W. T. H.

Some experiments conducted with pure cultures of bread yeast. WILLIAM F. HENDERSON. James Millikin Univ. *Trans. Am. Microscopical Soc.* 38, 221-8(1919).—In the expts., use was made of glucose, galactose, fructose, sucrose, maltose, and lactose. Glucose and fructose caused yeast to grow much more rapidly than did any of the other sugars. Glucose (and probably fuctose) gave rise to the most rapid production of CO_2. Of the disaccharides, sucrose was most suitable, but did not compare favorably with glucose. While growth of the yeast occurred best under aerobic conditions, development also took place in the proper medium under at least limited anaerobic conditions. For the accumulation of gas in a fermentation tube, it must be produced in amt. sufficient more than to sat. the liquid, and at a rate sufficient to overcome loss by diffusion through the open air. A solid medium may materially alter the morphological characters of the individual yeast cells by a tendency to localize the food supply.

JOSEPH S. HEPBURN.

Nitrogenous and phosphoric acid materials in the maturation and germination of wheat. EUG. ROUSSEAUX AND SIROT. *Compt. rend.* 171, 578–80(1920); *C. A.* 6, 1934; 12, 961, 2029, 2391.—Samples of wheat were collected at intervals of 2 to 4 days, beginning June 23, when the grain was very milky with little distinction between its layers, and ending on July 31, 5 days after the harvest. The wt. of 100 seeds increased from 3.0 g. on June 23 to 9.33 on July 11, then fell to 5.80 at the harvest July 26, and to 5.30 on the 31st. Water content dropped from 72 to 12.1% in the 41 days. Acidity as H_2SO_4 fell from 0.3 to 0.015 at the harvest. Total N was quite constant throughout, the extremes being 2.1 on June 23 and 2.68 on July 3. Sol. N. decreased from 1.03 on June 23 to 0.225 on July 11, then increased to 0.341 at the harvest. Total P_2O_5 generally increased from 0.96 on June 23 to 1.03 on July 9, was erratic between 0.92 and 0.98 until July 31 when it stood at 1.01. Sol. P_2O_5 decreased from 0.739 on June 23 to 0.280 on July 11, then increased to 0.35 at the harvest. Analyses were made at the beginning, middle and end of a germinating period of 5 days. Results showed that the acidity increased, total N remained unchanged, sol. N increased from 0.328 to 0.838, total P_2O_5 was slightly decreased and sol. P_2O_5 increased from 0.350 to 0.540. L. W. RIGGS.

Action of hydrogen peroxide on flour. MARION. *Compt. rend.* 171, 804-6(1920).—The rate of milling of wheat (taux d'extraction) can be detd. from the amt. of O liberated by the action of the catalase in the flour from H_2O_2. The quantity of O describes a regular curve following the quality of the flour. Method and characteristic results are given.

H. A. LEPPER.

The swelling of gluten protein and its significance for the problem of the capacity for baking. H. LÜERS. Munich. *Z. Elektrochem.* 26, 420-4(1920).—A discussion of the gluten problem and the problem of the capacity for baking from the standpoint of phys. chemistry. The importance of a knowledge of the phys. chemistry of bread making is indicated.

H. JERMAIN CREIGHTON.

An experimental study of the effect of certain organic and inorganic substances on the bread-making properties of flour and on the fermentation of yeast. HELEN MASTERS AND MARGERY MAUGHAN. King's College for Women. *Biochem. J.* 14, 586–602(1920).—The dough raised with yeast consisted of 200 g. flour, (containing varying amts. of wheat, barley, maize, rye and rice.—"war" bread) 5 of yeast, 2 of sugar and 2 of salt and 95–120 cc. of liquid, mainly tap water, but also including any other liquid included for the expt. The addition of lime water produced little or no effect. One % fresh serum markedly increased the vol. of the loaf. Among phosphates, NaH_2PO_4 proved best. The addition of boiled potato increased the vol. by 4.2%. Malt ext. did not increase the size of the loaf. Similar expts. were carried on with doughs raised by a chemical agent (1 g. $NaHCO_3$ + 2 g. $KHC_4H_4O_6$). The addition of phosphates to such doughs showed no increase in the vol. of the loaf. The fermentation produced by yeast with sugar and water and in the dough was obtained on the second or third day after the yeast had been compressed. Usually the max. increase in vol. on baking was obtained when the dough was allowed to rise for 40 minutes.

BENJAMIN HARROW.

Purification and regeneration of used lubricating oils. EMILE SAILLARD. *Circ. hebd. synd. fabr sucre* Dec. 14, 1919. *Z. Ver. Zuckerind.* 70, 470.—The warm oil is mixed with 5% of H_2SO_4 of 52° Bé., and thoroughly agitated with it. Then 5% of a mixt. of equal quantities of Na tannate and gelatin, which mixt. must have an acid reaction, is stirred into the oil. The latter is siphoned off after 24 hrs., or centrifuged after 2–3 hrs.

F. W. ZERBAN.

The determination of sucrose in the presence of both invert sugar and raffinose. WALLACE MONTGOMERY. *Intern. Sugar J.* 22, 580–2(1920).—First the "total sucrose" (sum of sucrose and invert sugar, figured as sucrose) and the raffinose are detd. according to Baumann's method *(Z. Ver. Zuckerind,* 48, 779(1898). Then the invert sugar is detd. in the original sample by means of Fehling soln., the result multiplied by 0.95 and substracted from the "total sucrose;" the difference is actual sucrose. Two tablets are appended, for calcg. the factors *F'* and *F'''* in the Baumann formula, from the reduced Cu found.

F. W. ZERBAN.

Chemistry of the polysaccharides. E. HERZFELD AND R. KLINGER. *Biochem. Z.* 107, 268–94(1920).—Methods are briefly given for the prepn. in pure form of the higher polysaccharides starch, cellulose, agar, glycogen and inulin, and the soly. decompn., I_2-reaction, ozazone reduction and $Ba(OH)_2$ and tannin reaction are tabulated. The I_2 reaction depends on the absorption of I_2 on the surface of the colloid particles and the changes in color are related to the degree of dispersion of the latter: blue signifying a relatively coarse dispersion, red-brown a highly dispersed condition. Starch can be dextrinized by simple absorption of its surface by solns. *(e. g.* formaldehyde) going from the gross to the finely state of dispersion. *Dextrins are not split products of starch, but are simply more highly dispersed starches.* The action of the diastatic enzymes is also considered to be a simple alteration of the degree of dispersion of the starch conditioned by the going into soln. mixts. whereby the previously insol. particles receive H_2O-combining surfaces and become colloidally divided. From this the grossly dispersed starch first goes over into smaller particles, (I_2 positive dextrins) and these again into a still more disperse I_2-negative state *without hydrolysis being necessary.* No splutting to sugar could be observed as the consequence of the action of this enzyme. The enormous increase of surface is obviously an important prepn. for the latter hydrolysis. The active materials of the diastase are apparently split products of the lipoids or protein bodies or their derivatives. The many polysaccharides of the plant world are not significantly different one from the other in either chem. or phys. properties: their apparent differences lying in the dextrin particles produced by the soln. mixts. and the presence or absence of foreign materials, such as protein, lignin, etc. Since the starch that has gone over to dextrin is sol. and can pass through membranes, the old conception of a starch-splitting into sugar and a rebuilding into polysaccharide is unnecessary. Animal glycogen is identical with the dextrinized starch, and its presence in the animal body is considered as due to the nature of the soln. mixts.

preventing the survival of gross starch particles but little dispersed.

F. S. HAMMETT.

Oxidizing enzymes. II. The nature of the enzymes associated with certain direct oxidizing systems in plants. M. W. ONSLOW. *Cambridge. Biochem. J.* 14, 535-40(1920); cf. *C. A.* 13, 2886.—Three components are present in oxidase systems: A "catechol" compd. which may give rise to a peroxide, and 2 enzymes—an oxygenase which helps the formation of the peroxide, and the peroxidase, which decomposes the peroxide forming "active" O. The peroxidase may be partially sepd. from the oxygenase by fractional pptn. with alc. **III.** The oxidizing enzymes of some common fruits. *Ibid* 541-547.—The oxidizing enzymes present in the apple, quince, pear, plum, banana, orange lemon, lime and raspberry were investigated. The author shows how divergent results may be obtained depending upon whether the test is performed on the fresh tissue, or on exts. prepd. in different ways. Such substances as org. acids, tannins, etc., may interfere with the reactions.

BENJAMIN HARROW.

Sorption by cellulose (filter paper) and starch. Study of imbibition. K. SCHERINGA. Utrecht. *Pharm. Weekblad* 57, 1289–94(1920).—Absorption or adsorption by cellulose is largely due to its capillary structure. With many neutral salts there is practically no adsorption; heavy metals and alkaloids may be adsorbed from very dil. neutral soln. but not from acid soln.; alkalies may be adsorbed, partly due to impurities in the cellulose. Positive colloids (as metal oxide sols) are strongly adsorbed by coagulation, while negative colloids (as sulfide sols) are not, and so pass readily through filter paper. Gases are not perceptibly adsorbed. Albumin is adsorbed from very dil. acid soln. but not from urine, which probably contains substances which inhibit the adsorption. Filter paper may therefore be safely used to *filter urine for albumin analysis*. The above expts. were made with filter paper dried at 120°. Air-dried paper, which may contain as much as 20% moisture, gives different results (Evans, *J. Phys.* 10, 290(1906)). Starch, a much more disperse system than cellulose, shows selective adsorption; negative with NaCl, positive with $CuSO_4$ in very dil. soln. but negative in more concd. soln.

JULIAN F. SMITH.

The hygroscopic moisture of flour exposed to atmospheres of different relative humidity. C. H. BAILEY. *J. Ind. Eng. Chem.* 12, 1102–4(1920).—The moisture content of flour in equil. with the atm. is a function of atm. humidity. The rate at which equil. in moisture contents is approached apparently depends upon conditions of exposure. Hygroscopic moisture in flour which was in moisture balance with atm. humidity at 25° ranges from about 5¼% of moisture at 30% relative humidity to 15% of moisture at 80% relative humidity. C. H. BAILEY.

Gluten in Italian pastes. A. CUTOLO. *Bol soc. nat. Napoli* [2] 10, 130–69 (1917); *Expt. Sta. Rec.* 42, 162.—An outline of process of manuf., analyses of various types of Italian food pastes and exptl. studies on changes taking place in the gluten of the flour in the manufacture of the pastes are given. The agglutinating property of the gluten is lowered and not its solubility by enzyme action, especially during drying. The amount of extractable gluten is thought to be an index of the quality of the paste and the nearer it approaches the total N the better the quality from organoleptic, com. and gastronomic points of view. H. A. LEPPER.

Bread. R. L. CORBY. U. S. 1,355,127, Oct. 12. Proper conditioning of the dough mass in making bread is attained with relatively small amt. of yeast by the addition to the flour used in making the dough of a mixt. of H_2O 62 lbs., sucrose 3.5 lbs., and NaCl 2 lbs. for every 100 lbs. of flour and 2.5 lbs. of yeast; or, preferably, by replacing the sucrose by a material rich in maltose, dextrin and dextrose and using a much smaller proportion of yeast. U. S. 1,355,128 relates to a method of producing a yeast-economizing and dough-conditioning compn. of the latter class by forming a liquid containing saccharine substances of the maltose class and proteins, acidifying the mass to the point where the diastatic and proteolytic materials are rendered inert, then more highly acidifying the mass. The acidification is carried to the point where the acid will be sufficient properly to condition the gluten of the dough flour, but not to prevent nourishment of yeast by the proteins and saccharine substances of the compn.

Bread-making ingredient. R. L. CORBY, U. S. 1,355,129, Oct. 12. A compn. for use with flour in prepg. a bread dough batch is prep. as follows. Rye malt, barley malt or barley sprouts or similar material is heated with H_2O to 50–75° for 2–5 hrs. to effect liquefaction of the starch and production of maltose, dex-

trose and dextrine. Sucrose is added and the mixt. is subjected to the action of a culture of lastic acid bacteria which act upon the maltose, dextrose and dextrins with production of lactic acid and render the diastatic and proteolytic enzymes substantially inert, and further act upon the sucrose to convert it into invert sugars, with further production of a material proportion of free acid. After this acidification, the material is heated to 85-95° which coagulates substances such as undigested proteins which might discolor dough in which the compn. is used. Insol. substances are filtered out and the filtrate is concd. by evapn. and sterilized.

H. A. LEPPER.

Determination of glucose and starch by the alkaline potassium permanganate method. F. A. QUISUMBING. *Philippine J. Sci.* 16, 581–99(1920).—Under carefully controlled conditions which have been experimentally worked out, glucose and starch may be detd. by oxidation in alk. soln. with $KMnO_4$. The method is proposed as a possible substitute for the regulation Munsen and Walker method, although it offers no advantages other than a saving of time and material. To det. glucose, place in a 400 cc. Erlenmeyer flask 55 cc. of 0.1 *N* $KMnO_4$, 25 cc. Na_2CO_3 soln. containing 8.48 g. Na_2CO_3 per 1., and 25 cc. of the glucose soln. to be analyzed, the total vol. being exactly 100 cc. Heat in such a way that the temp. is raised from 29° to 95° in 2 min., and continue heating at 95° for exactly 2 min. Remove the flask and add gradually 25 cc. of 28% H_2SO_4 and 25 cc. 0.1 *N* $(CO_2H)_2$. Titrate the excess $(CO_2H)_2$ against standard $KMnO_4$, adding the latter until the liquid assumes a pink color which is retained for a few seconds. The wt. in mg. of glucose is found from the net cc. of 0.1 *N* $KMnO_4$ actually used in oxidation by means of the table given below. To det. starch, stir a 2–3 g. sample of the dry material with 50 cc. cold H_2O for 1 hr. Filter and wash with 250 cc. cold H_2O. Heat the insol. residue for 3–4 hrs. with 200 cc. H_2O and 15 cc. conc. H_2SO_4 in a flask provided with a return condenser. Cool and neutralize exactly with NaOH soln. Bring the vol. to 500 cc., filter, and detn. the dextrose in a 25 cc. aliquot portion as described below. The wt. of starch in mg. is read off from the table below. In the case of flour the acid hydrolysis gives results about 10% too high, and therefore flour should be hydrolyzed at 40° with 25 cc. of saliva until no test for starch is obtained with I.

TABLE

Cc. 0.1 *N* $KMnO_4$	Mg. Glucose	Mg. Starch
5.40	4	3.72
6.54	5	4.65
7.68	6	5.58
8.76	7	6.51
9.84	8	7.44
11.08	9	8.39
12.32	10	9.30
13.45	11	10.23
14.58	12	11.16
15.75	13	12.09
16.93	14	13.02
17.85	15	13.92
18.77	16	14.88
20.13	17	15.81
21.49	18	16.74
22.74	19	17.67
23.99	20	18.60
25.13	21	19.53
26.28	22	20.46
27.88	23	21.39
28.48	24	22.32
29.47	25	23.25
30.46	26	24.18
31.67	27	25.11
32.88	28	26.09
33.81	29	26.97
34.75	30	27.90
35.80	31	28.83
36.86	32	29.76
37.58	33	30.69
38.24	34	31.62
39.38	35	32.55
40.52	36	33.48
41.05	37	34.41
41.58	38	35.34
42.22	39	36.17
42.86	40	37.20
43.35	41	38.13

S. G. SIMPSON.

Constitution and properties of boiler tubes. A. E. WHITE. *Mech. Eng.* 42, 303-6(1920).—The causes of tube failure are due to tube brittleness resulting from the absorption of H by the metal and usually attributable to faulty boiler-feed-water treatment, to blowholes or other imperfections in the metal, and to recrystn. of the metal. These causes are discussed and supplemented with photomicrographs. The grain growth under temps. below the critical point is an important factor. It is thought that a C content varying between 0.30 and 0.35% will insure longer life for the tube and safer boiler operation than a C content between 0.08 and 0.18%. V. O. H.

Corrosive value of waters. P. J. THIBAULT. *Australasian Chem. Met.* 3, 14 (1920).—The corrosion value of H_2O is the amt. of Fe that a H_2O will dissolve or transform to an oxide when treated under standard conditions. The test is intended to serve as a measure of the corrosion

that will take place in steam boilers. Select a glass-stoppered bottle of about 200-cc. capacity. A piece of mild steel is next machined to about ½ in. in width and ¼ in. in thicknss and of a length a little less than that of the bottle. The capacity of the bottle under working conditions is detd. by inserting the steel into the bottle, then filling to overflowing with distd. H_2O, then inserting the stopper. The stopper is then withdrawn, and the H_2O remaining in the bottle is transferred to a measuring cylinder, and thus the contents of the stopped bottle with its piece of Fe is detd. The bottle is next filled with the H_2O to be tested, which must be free from solids in suspension. The Fe contents of the H_2O must be detd. The bottle is filled to overflowing, the stopper is inserted, care being taken that air bubbles are not formed. The stopper is next securely wired down. The bottle and contents are next placed in a boiler containing cold H_2O and gradually brought to the boiling point, the boiling being maintained from the time that the H_2O reaches 100° for a period of 6 hrs. A slight pressure is generated, and as the bottles sometimes burst it is advisable to wrap them securely in a towel. The bottle is removed from the heat and allowed to stand until cold. The H_2O in the bottle is transferred to a large beaker, the strip of Fe Washed with cold distd. H_2O and any ppt. adhering to the glass bottle is removed by an acid wash that is added to the H_2O in the beaker. The Fe is detd. by a suitable method. The Fe so found—Fe in the H_2O × 100 ÷ the vol. of the H_2O in the bottle = the corrosion value of the H_2O.

V. O. HOMERBERG.

Bearing metals and their industrial application. J. CZOCHRALSKI. *Z. Metallkunde* **12**, 371-403(1920).—Early in the war (1915) the available tin in Germany was about 4500 tons with a normal demand for bearing metals alone of 10,000 tons. Extended investigations of bearing-metal materials were, therefore, undertaken and are reported in condensed form by C. The effects of pouring temps. on the common bearing alloys are illustrated by photomicrographs with special reference to the new Pb-Ba and Pb-Ca alloys. Tables and curves show the physical properties of the alloys studied and indicate the decided advantages of the Pb-Ba bearing metals for many uses. C. describes in detail, with drawings, the methods of making and melting bearing metals and the methods of attaching the bearing layer to bushings especially with the new alloys. Correct and incorrect methods for the seating of the shaft in the bearing in connection with lubrication are illustrated. An instrument for measuring the bearing efficiency of different metals is described. The paper is followed by an extended discussion and has many photomicrographs, charts, line drawings of furnaces and photographs of machines. R. S. WILLIAMS.

The nature of enzymes. MAXIMILIAN HERZOG. *Monograph, Chicago* 1920, pp. 107.—This monograph, which contains the results of an incomplete series of investigations was published from the notes of the author, compiled after his death, by the Chicago Municipal Tuberculosis Sanitarium. It consists of an investigation of the hypothesis that enzymes are living things, possessing the power of assimilation, metabolism, growth and reproduction; that they are, in fact, the real basis of life, which is due to the activities of these exceedingly small ferment granules. They constitute the elementary corpuscles postulated by biologists. The basic observation is that fresh saliva, added to antiseptic, synthetic, culture media and incubated, was found to exhibit a considerable rise in amylolytic power, together with an increase of coagulable protein N to several multiples of the original amts., which observations are interpreted as indicating a multiplication of the enzymes. After a time the amylolytic power and protein content of the soln. fall, which is attributed to the existence in saliva of proteolytic enzymes which are themselves not proteins. Granules can be demonstrated in the incubated fluids by ultramicroscopic methods, which are believed to be the enzymes themselves. It was not possible to propagate the enzymes from generation to generation in artificial cultures. The nutrient fluid used contained 30-50% of glycerol, 2% phenol, 0.2% NaF, NH_4 lactate and morphine sulfate as sources of N, and also NaCl, $MgSO_4$, $CaCl_2$, H_2KPO_4, K Sb tartrate. The author holds that each fermentation product, such as amylodextrin, erythrodextrin, achroödextrin, represents changes of generation occurring in the ptyalin granules engaged in splitting up the polysaccharide, starch. Each generation of granules possesses the power of assimilation, metabolism, nutrition, and growth; but only one generation possesses the power of reproduction, and that is the generation which is continually forming anew in the gland which furnishes the enzyme. This first generation does not, however, possess the characteristic fermentative power towards a definite substance (starch, proteins, etc.), and this generation of reproducing enzyme granules heretofore has been

known as the zymogen stage of the enzyme. Heating even to 80° C. for 130 min. did not completely destroy ptyalin, since a trace was left which could form a little maltose in 11 days; 5 minutes heating at 80°, reduced the ptyalin activity but little. Propagation of ptyalin granules derived directly from salivary glands, is described. There are also considerations of the properties of ptyalin and its relation to malt diastase, the nature of toxins and the fallacies of the Ehrlich side-chain theory, and the adaption of enzymes to changes in temp.

H. G. WELLS.

Nutritional requirements of yeast. I. The role of vitamines in the growth of yeast. ELLIS I. FULMER, VICTOR E. NELSON AND F. F. SHERWOOD. *J. Am. Chem. Soc.* 43, 186-91(1921).—A study was made of the effect upon the growth of yeast in a basal medium (containing in 100 cc. 0.30 g. $(NH_4)_2SO_4$, 0.20 g. KH_2PO_4, 0.025 g. $MgSO_4$ and 10 g. cane sugar) of various quantities of alfalfa and wheat embryo exts. (prepd. by extg. the substances 6 hrs. with hot C. P. anhydrous Et_2O, then 8 hrs, with hot alc. and evapg. the alc. exts. to dryness). Plotting the dry equiv. of ext. used against growth it is found that both exts. show optimum concns. but the optimum concn. of the alfalfa ext. (1.2 g. dry equiv. per 100 cc. medium) is far more potent than the wheat embryo ext. at its optimum concn. (0.06 g.). The wheat embryo curves up to the optimum have steeper slopes than the alfalfa curves and cross the latter at the concn. of 0.13 g. per 100 cc. The relative potencies of 2 materials can therefore not be detd. by comparison of the effects from exts. of equal wts. of dry materials. McCollum and Simmonds (*C. A.* 12, 711) have shown that water-soluble B is readily destroyed by dil. alkali; when the above exts. were heated 1 hr. with 5% NaOH under 7 kg. pressure, their properties as yeast stimulants were not injured. In two series of expts. the medium was composed of 10% sugar plus the optimum concn. of alfalfa ext. in one case and of wheat embryo ext. in the other; yeast has been growing in these media for 3 months, being transferred every day to fresh media. A medium (F) free from unknown constituents (see following abstr.) has been developed in which yeast has been growing satisfactorily for 10 months. It is concluded that water-soluble B is not a necessary constituent of a medium for the growth of yeast and that the alc. exts. of alfalfa and wheat embryo contain nitrogenous and org. materials which will maintain the growth of yeast. **II. Effect of the composition of the medium on the growth of yeast.** *Ibid* 191-9.—With a medium containing 0.100 g. K_2HPO_4, 0.100 g. NH_4Cl, 0.0 g. $CaCl_2$, 0.100 g. $MgSO_4$, 0.020 g. $CaCO_3$ and 10 g. saccharose in 100 cc. as basal the effect of varying one constituent at a time was studied. As a result it has been found that the following is the most satisfactory medium (referred to as F in the preceding abstr.) for growing yeast at 30°; 0.188 g. NH_4Cl, 0.100 g. $CaCl_2$, 0.100 g. K_2HPO_4, 0.040 g. pptd. $CaCO_3$, 0.60 g. dextrin, 10 g. sugar. The optimum concn. of several NH_4 salts (sulfate, nitrate, tartrate) was found to be identical with that for NH_4Cl which is that in which a protein (wheat gluten) is least swollen and which varies with the temp. Asparagine does not improve the medium.

CHAS. A. ROUILLER.

Report on water in foods and feeding stuffs. J. O. CLARKE. *J. Assoc. Off. Agr. Chem.* 4, 48-55(1920).—Six different methods for detg. H_2O were studied by collaborators on cottonseed meal, wheat bran, corn meal and air-dried silage, and six methods were tried on dried apples. Heating in vacuum at 100° gives higher results than any other heating methods in general use. Different heating methods give somewhat different results on the same sample. The H_2SO_4-vacuum method gives results agreeing well with heating in vacuum at 100°. This method was recommended for official adoption. Best results are obtained with a pressure less than 2 mm. the completeness of drying depending largely on the last few mm. exhausted. The CaO-vacuum method gives slightly lower results than when H_2SO_4 is used and requires a somewhat longer time. The carbide-vacuum method is equal in efficiency to the CaO method. These two methods were recommended for tentative adoption. Dried apples and similar products cannot be dried above 70° without decompn. None of the vacuum desiccator methods removes all the H_2O from apples, giving results lower than the empirical method of drying 4 hrs. in H_2O oven. Heating or desiccator methods did not affect the subsequent Et_2O ext. results on feeding stuffs. Substances which dry on heating, *e. g.*, meat, give more satisfactory Et_2O extn. if dried by desiccator methods.

H. A. LEPPER.

Report on crude fiber. C. K. FRANCIS. *J. Assoc. Off. Agr. Chem.* 4, 39-41(1920).—Collaborative results reported show that the one-filtration method does not check the official method, results being higher and does not give checks between different analysts. Cf. *C. A.* 14, 781.

H. A. LEPPER.

A provision against the evaporation during filtration of sugar solutions that are to be polarized. J. J. WEISS. *Listy Cukrovar.* **38**, 155(1920).—Considerable error was introduced by this factor until a closed system of filtration was used.
JOHN M. KRNO.

The use of membrane filters in chemical analysis. L. MOSER AND KITTL. *Chem. Ztg.* **44**, 637-8(1920).—M. and K. refer to the work of Zsigmondy and Jander (*C. A.* **14**, 703), in which the use of membrane filters in the filtration of colloidal ppts. is suggested. It is also observed from the work of Zsigmondy, Wilke-Dörfurt and Galecki (*C. A.* **6**, 1576), that filter membranes can be used to advantage in quant. analysis. M. and K. use a filtering app. similar to that used by Zsigmondy, with the exceptions that the curvature of the sieve plate was 6 mm. and the ring was 5.7 cm. high. M. and K. found these changes in the filtering app. to be distinctively advantageous, especially facilitating the washing and removal of the ppt. The colloidal soln. is filtered slowly, care being taken to prevent the soln. coming into contact with the rubber packing of the app. In washing the ppt. M. and K. suggest the use of 10-15 cc. portions instead of 25 cc. as suggested by Zsigmondy and Jander. The filtration operation, once started, is carried to completion owing to the susceptibility of such ppt. to crack and make inefficient subsequent washing. Care should be exercised in the removal of the ppt. from the filter membrane which often appears black with impregnated ppt. and in some cases, the original color only returns after treatment with moderately concd. HNO_3. While the speed of filtration through filter membranes is not comparable to that of filter-paper filters or correctly prepd. asbestos filters, yet with the agency of suction most colloidal ppts. filter fairly rapidly. An exception is ZnS, but M. and K. suggest a preliminary treatment for such a colloid which greatly increases its speed of filtration. The advantages of this method of filtration especially for such substances as colloidal Bi, Ag, ZnS and other hydrosols is pointd out. C. S. ADAMS.

Determination of copper (particularly with respect to sugar determinations) by means of potassium thiocyanate and potassium iodide. G. BRUHNS.. *Z. anal. Chem.* **59**, 337-59(1920).—Partly to save the expense during the war, an excellent method for the iodometric detn. of Cu has been devised in which KI is replaced for the most part by KCNS or NH_4CNS and yet in the final titration the same quantity of $Na_2S_2O_3$ is used. According to the old method 2 moles of Cu^{++} react with 4 moles of KI and liberate I_2 to react with 2 moles of $Na_2S_2O_3$, but the Cu is all precipitated as Cu_2I_2 and an excess of KI is necessary to keep the liberated I_2 in soln. as I_3^-. In the new method one or the other of the following reactions take place, both of which lead to the same results: $2Cu^{++} + 4I^- \rightarrow Cu_2I_2 + I_2$ and $Cu_2I_2 + 2CNS^- \rightarrow Cu_2(CNS)_2 + 2I^-$ or $2Cu^{++} + 2CNS^- + 2S_2O_3^{--} \rightarrow Cu_2(CNS)_2 + S_4O_6^{--}$. Again 50 cc. of Fehling soln. was generally used for all reduction expts., but it has been found that 20 cc. is sufficient and only 100 mg. KI are required if 0.65 g. of KCNS or 0.5 g. of NH_4CNS is present. In the analysis of sugars, B. recommends the following working directions: Mix 20 cc. of sugar soln. with 10 cc. of Cu soln. (69.28 g. of sulfate crystals per liter or an equivalent amt. of nitrate or chloride). 10 cc. of alk Rochelle salt soln. (346 g. Rochelle salt and 100 g. NaOH per liter) in a 200 cc. Erlenmeyer and boil exactly 2 min. over a small flame. Immediately add 50 cc. of water that is at room temp., place a small beaker over the mouth of the flask and cool the contents by running water. When at room temp. add 5 cc. of iodide-thiocyanate soln. (contg. 13 g. KCNS and 2 g. KI per 100 cc.), shake well, introduce 10 cc. of 6 *N* HCl or 6.5 *N* H_2SO_4 and titrate promptly with $Na_2S_2O_3$ soln. (34.4 g. of the salt and about 0.1 g. NaOH per liter). Titrate rapidly until the brownish coloration begins to appear gray. Add sufficient starch soln. and titrate slowly until a leather-yellow (or red with considerable Cu_2O) precipitate is seen and the blue iodide of starch color does not return in 5 min. If there is a large sepn. of Cu_2O, add starch at the beginning of the titration and, to accelerate the liberation of I, do not cool below 30°. Tables are given for the computation of the results. W. T. H.

Some relations between the configuration and the optical rotary power of some derivatives of acids of the sugar group. MISS TH. W. J. VAN MARLE. Univ. Leyden, *Rec. trav. chim.* **39**, 549-72 (1920).—Van't Hoff studied the influence of the cyclic bond on the quantity of rotation. It is capable of changing the sign. Thus the lactones derived from sugar acids have a rotatory power equal to that of the corresponding sugars, while the alcs. obtained by their reduction and the acids formed by their oxidation have on the contrary a feeble rotation. If the rotation of the lactones is the consequence of this cycle the sign of the rotation of the lactone will be debtd. by the place of the cycle. Hudson (*C. A.* **4**, 1466) has stated the following hypothe-

sis: Lactones of *d*-rotation have the lactonic ring on one side of the structure, lactones of *l*-rotation have it on the other, and the position of the ring shows the former position of the OH group on the *v*-C atom. This rule was verified by H. and by Anderson (*C. A.* **6**, 737) for many acid lactones. Later H. (*C. A.* **11**, 1426) also found the following rule: The direction of rotation of the phenylhydrazide indicates the configuration of the HO of the *a*-C atom. If the phenylhydrazide rotates to the right, the HO on the *a*-C is on the right and *vice versa*. In this paper Miss v. M. has tested the latter rule for a series of substituted hydrazides. *Hydrazides of some hexonic and pentonic acids and some of their derivs.* The hydrazides of hexonic and pentonic acids are easily obtained by boiling their lactones in EtOH with $N_2H_4.H_2O$ under a condenser. They often sep. as crystals. 3.6 g. *d*-gluconic acid lactone are dissolved in 50 cc. 96% boiling EtOH and after some preliminary treatment 1 cc. of 90% $N_2H_4.H_2O$ is added and the mixt heated. The *d*-gluconic acid hydrazide (A) (Weerman *C. A.* 12, 1465) seps. as colorless tabular crystals, m. 142°, $[a]^{12}/D$ 30.4° in H_2O, 20.9° in C_5H_5N. 1 g. A in 10 cc. H_2O + an equimol. amt. of BzH gave the benzalhydrazide, colorless, m. 157° $[a]^{17}/D$ +46.6° in C_5H_5N. A treated similarly with *p*-$MeOC_6H_4CHO$ *gave d-gluconic acid p-methoxybenzalhydrazide*, m. 185° (decompn.), $[a]^{15}/D$ 54.0° in C_5H_5N. *d*-Mannonic acid lactone treated as with A gave *a-mannonic acid hydrazide* (B), colorless spangles, m. 161° (decompn.) $[a]^{15}/D$ —2.7° —3.0° in H_2O, —38.8° in C_5H_5N. B treated as above with BzH gave the *benzalhydrazide*, colorless, M. 194° (decompn.) $[a]^{13}/D$ —8.0° in C_5H_5N. The *p-methoxy-benzalhydrazide of* B seps. as colorless crystals, m. 191° (decompn.), $[a]^{15}/D$ —18.8° in C_5H_5N. *d-Galactonic acid hydrazide* (C) was obtained as microcrystals, m. 178°, $[a]^{13}/D$ 40.1° in H_2O, 31.1° in C_5H_5N. The *benzalhydrazide* of C forms colorless spangles, m. 193° (decompn.), $[a]^{18}/D$ 63.4° in C_5H_5N. The *p-methoxybenzalhydrazide* of C forms colorless crystals, m. 191° (decompn.), $[a]^{16}/D$ 67.7° in C_5H_5N, decomp. in H_2O. *l-Gulonic acid hydrazide* (D) is a sirup which could not be crystd., $[a]^{12}/D$ 4.3° in H_2O. The *benzalhydrazide* of D seps. as colorless spangles, m. 173° (decomp. 183°), $[a]^{17}/D$—11.2° in C_5H_5N. The *p-methoxybenzalhydrazide of* D seps. as shining colorless spangles, m. 176–7° (decompn.), $[a]^{14}/D$ —2.9° in C_5H_5N. *l-Idonic acid hydrazide* (E) was obtained as a sirup, $[a]^{5}/D$—21.8 in H_2O. The *benzal-hydrazide* of E seps. as colorless crystals, m. 153°, ([*a*] is not given). *Isosaccharic acid hydrazide* (F) was obtained as a sirup, $[a]^{12}/D$ —11.6° in H_2O. The *benzalhydrazide* of F seps. as pretty colorless spangles, m. 147° if heated slowly and 140-4° if heated rapidly, $[a]^{17}/D$ —48.2° in C_5H_5N. The *p-methoxybenzalhydrazide* of F seps. as colorless crystals, m. 138° (decompn.), $[a]^{14}/D$ —36.2° in C_5H_5N. *l-Arabonic acid hydrazide* (G) seps. as colorless spangles, m. 138°, $[a]^{12}/D$ 52.6° in H_2O, 61.8° in C_5H_5N. The *benzalhydrazide* of G forms colorless spangles, m. 208° (decompn.), $[a]^{5}/D$ —21.8° in H_2O. The *benzalhybenzalhydrazide* of G forms colorless crystals, m. 208° (decompn.), $[a]^{17}/D$ 81.7° in C_5H_5N. *d-Ribonic acid hydrazide* (H) gave colorless crystals. m. 150°, $[a]^{15}/D$ 27.5°. The *benzalhydrazide of* H gave colorless crystals, m. 138–42° (decompn.) ([*a*] not given). *l-Xylonic acid hydrazide* (I) was obtained as a viscous mass, $[a]^{15}/D$ 34.5°. The *benzalhydrazide* of I gave colorless crystals, m. 153-5° ([*a*] not given). *d-Lyxonic acid hydrazide* (J) gave colorless spangles, m. 188°, $[a]^{14}/D$ —3.6° in H_2O. The *benzalhydrazide* of J seps, as a colorless compd., m. 175° (decompn.) ([*a*] not given). *p-Bromophenyl- and p-, o- and m-tolylhydrazides of some hexonic and pentonic acids.* These hydrazides are easily obtained by boiling the acid lactones in EtOH with equimol amts. of the substituted hydrazine and generally sep. as colorless crystals, although sometimes they are obtained as sirups. They are generally little sol. in boiling H_2O which decomps. them slowly. The *p-bromophenylhydrazide* of *d*-gluconic acid (K) m. 203° (decompn.), $[a]^{20}/D$ 3.6° in H_2O, $[a]^{9.5}/D$ —15.3° in C_5H_5N. The *p-tolylhydrazide* of K m. 204°, $[a]^{5}/D$ 5.0° in H_2O, $[a]^{24}/D$ 2.0° in C_5H_5N. The *o-isomer* m. 218° (decompn.), $[a]^{22}/D$ 13.7° in H_2O, $[a]^{17}/D$ 5.1° in C_5H_5N. The *m-isomer* m. 185° (decompn.), $[a]^{16}/D$ 4.5° in H_2O, $[a]^{14}/D$ 2.7° in C_5H_5N. The *p-bromophenylhydrazide* of *d*-mannonic acid (L) m. 225° (decompn.), $[a]^{35}/D$ —7.3° in H_2O, $[a]^{10}/D$ —24.9° in C_5H_5N. The *p-tolylhydrazide* of L m. 208° (decompn.), $[a]^{16}/D$ —10.9°, $[a]^{14}/D$ —24.8°. The *o-isomer* m. 208° (decompn.), $[a]^{16}/D$ —8.7° in H_2O, $[a]^{14}/D$ —28.6° in C_5H_5N. The *m-isomer* m. 214° (decompn.), $[a]^{22}/D$ —12.5° in H_2O, $[a]^{14}/D$ —24.7° in C_5H_5N. The *p-bromophenylhydrazide* of d-galactonic acid (M) m. 125° (decompn.), $[a]^{18}/D$ 2.5° in H_2O, $[a]^{10}/D$ —30.3° in C_5H_5N. The *p-tolylhydrazide* of M m. 212° (decompn.), $[a]^{6}/D$ 2.9° in H_2O, [a] $^{14}/D$ —13.5° in C_5H_5N. The *o-isomer* m. 191° (decompn), $[a]^{12.5}/D$ 12.2° in H_2O,

$[\alpha]^{19}/D$ —8.6 in C_5H_5N. The *m-isomer* m. 174° (decompn.), $[\alpha]^{13}/D$ 0.8° in H^2O, $[\alpha]^{14}/D$ —15.8° in C_5H_5N. *p-Bromophenylhydrazide* of *l*-gulonic acid (**N**) could not be purified. The *p-tolylhydrazide* of **N** was not purified. The *p-tolylhydrazide* of *l*-idonic acid could not be purified. *p-Bromophenylhydrazide* of *l*-arabonic acid (**O**) m. 204° (decompn.), $[\alpha]^{17}/D$ 2.4° in H_2O, $[\alpha]^{9}/D$ —19.0° in C_5H_5N. The *p-tolylhydrazide* of **O** m. 216° (decompn.) $[\alpha]5/D$ 4.08° in H_2O, $[\alpha]^{14}/D$ —3.1 in C_5H_5N. The *o-isomer* m. 203° (decompn.), $[\alpha]^{5}/D$ 26.6° in H_2O, $[\alpha]^{14}/D$ —1.4° in C_5H_5N. The *m-isomer* m. 185° (decompn.), $[\alpha]^{5}/D$ 4.6° in H_2O, $[\alpha]^{14}/D$—5.0° in C_5H_5N. The *p-bromophenylhydrazide* of *d*-ribonic acid in 169° (decompn.) $[\alpha]^{16}/D$ 3.8° in H_2O, $[\alpha]^{10}/D$ 14.0° in C_5H_5N. The similar deriv. of *l*-xylonic acid could not be crystd. *Anilides and p-, o- and m-toluidides of some hexonic and pentonic acids.* These compds. were easily obtained by heating the lactone with the calcd. amt. of the NH_2 compd. but it is necessary to control the temp. carefully. The excess of the NH_2 compd. is removed by extg. with Et_2O and the product is crystd. from EtOH. The anilide of *d*-gluconic acid (**P**) was prepd. by Fischer and Passmore (*Ber.* 22, 2736 (1899)), $[\alpha]^{11}/D$ 50.6° in H_2O. The *p-toluidide* of **P** m. 181°, $[\alpha]^{14}/D$ 50.9°. The anilide of *d*-galactonic acid (**Q**) was prepd. by Kohn (*Monatsh.* 16, 342 (1895)) $[\alpha]^{17}/D$ 62.6° in H_2O. The *p-toluidide* of **Q** m. 224° (decompn.) $[\alpha]^{16}/D$ 72.9°. The *o-isomer* m. 204° $[\alpha]^{11}/D$ 49.9°. The *m-isomer* m. 212°, $[\alpha]^{14.5}/D$ 63.3°. The *anilide* of *l*-arabonic acid (**R**) m. 204°, $[\alpha]^{20}/D$ 68.1°. The *p-toluidide* of **R** m. 200°, $[\alpha]^{17}/D$ 68.2°. The *o-isomer* m. 172°, $[\alpha]^{11}/D$ 56.5°. The *m-isomer* m. 186°, $[\alpha]^{11}/D$ 67.7°. The results show that Hudson's rule quoted above holds for the compds. investigated in this paper when the rotation is measured in H_2O but not in C_5H_5N. The strong positive influence on the rotation exercised by the introduction of Ph and tolyl groups in the amides observed by Freundler, Guye, Walden, etc., was also found in these sugar derivs. The rotation of the *o-*, *m-* and *p*-toluidides increases in the order given. In the hydrazides the influence of the introduction of substituents was not so sharp. In general these substituted hydrazides were very little sol. in H_2O. The substituted phenylhydrazides were in general slow in crystg. and frequently gave jellies. The results are summarized in 2 large tables. E. J. WITZEMANN.

Studies of the colloidal state of proteins in yeast extract. I. Yeast juice protein in alkaline solution—relation to biological processes. A. FODOR. Univ. Halle a. S. *Kolloid-Z.* 27, 58-69 (1920); cf. *C. A.* 11, 3285; 13, 2883; *Fermentforschung* 3, 193 (1920)—Previous work convinced F. that the kinetics of polypeptide fermentation by yeast juice can be explained only on the theory that the substrate is absorbed by a colloid in the ext. This investigation was carried out to study the properties of this colloid, and to work out a *theory of the process of fermentation. Exptl.:* Treatment of the yeast juice with alc. gives a ppt. only a small part of which will dissolve in H_2O again, giving a soln. having the fermentative powers of the original juice, and from which a protein is thrown down by acids. This ppt., called the *acid coagulum*, is identical with the protein in the original juice and differs from the rest of the alc. ppt. only in H_2O soly. Since the acid coagulum could be obtained only in small amt. the expts were carried out chiefly with the alc. ppt. called *yeast juice protein.* This is a fluffy, nearly white powder containing 14.98% N and 4.03% P. On dissolving in alkali and repptg. it contains 13.92% N and only a trace of P. The protein does not swell in H_2O, but shows the typical peptization in dil. NaOH. An old sample requires 24–30 hrs. for soln. in 0.1 *N* NaOH but a freshly prepd. one dissolves at once. More alkali is required to dissolve the old sample. Drying the freshly prepd. product in a desiccator causes it to revert to the less rapidly sol. form. On dissolving in alkali and then neutralizing the alkali with acid, the protein ppts. but redissolves in more acid, a still larger excess again pptg. A 1% soln. of the protein in acid was prepd. and the H^+ concn. varied by adding NaOH. The viscosity was detd. by means of the Ostwald viscosimeter and the H^+ concn. by the gas cell method. The viscosity, which measures the hydration of the protein particles, has a minimum at the isoelec. point and reaches its max. in the region $P_H = 3.18$ to 2.8. These solns. all contained NaCl. The isoelec. point, detd. from the coagulation optimum, is $P_H = 4.6$. To dissolve the protein in alkali requires 5.50×10^{-4} g. equiv. NaOH per g. protein. NaOH solns. containing varying amts. of alkali were prepd. and measurements made of sp. cond., H^+ concn. and viscosity. The results show: (1) The cond. due to the org. complex attains much higher values than have ever been found for true (not colloidal) org. ions. (2) Up to a certain point the cond. is a linear function of the amt. of NaOH found by the protein, beyond which the curve bends to a max. (3) The viscosity increases with the NaOH bound, reaching a max. (4)

The amt. of NaOH bound on dissolving a given wt. of protein in a given amt. of NaOH is always the same, but the cond. and viscosity are not always the same. For a given amt. of NaOH bound, the cond. is inversely proportional to the viscosity. A study of the OH-concn. of a NaOH soln. of the protein at different dilns. gave results which could not be interpreted on the basis of electrolytic dissociation of a sodium proteinate. *Theoretical.* Pauli and his pupils explain the behavior of proteins in acid and alk. soln. on the theory that as ampholytes they form salts with acids or bases which are electrolytically dissociated, the complex protein ion being greatly swollen as a result of hydration. The following objections are made to this theory: (1) The laws of elec. dissocn. in dil. solns. are assumed to hold for these complex colloidal ions. (2) The cond. of these protein ions reaches higher values than are ever observed for true org. ions. (3) This theory does not account for the colloidal properties of the proteins. (4) On the basis of this theory Pauli and Matula (*C. A.* 14, 2348) find by applying Ostwald's rule to the cond. data for NaOH solns. of casein that the caseinate ion is trivalent. The curve of cond. *vs.* ratio of casein to NaOH should then be divided into 3 sections by 2 "breaks," corresponding to each of the 3 valences. This is not the case. The theory adopted is based on the formation of an adsorption compd. between protein and alkali. The OH– of the alkali is absorbed on the surface of the colloidal particles, forming a negatively charged shell. The cation of the alkali is held electrostatically in a positive shell between the charged particle and the dispersion medium. The adsorption results in subdivision of the particles. The rate of increase of dispersity with increase in OH– adsorbed is not always the same, but depends upon the previous condition of the colloid. The particles of the adsorption complex are swollen by taking up water which forms a shell about the entire complex, which may be represented thus: $[(P—OH)^-Na^+]$ H_2O. This hydration is greater the less the ratio of OH– adsorbed to the area of interface. The high cond. of the adsorption complex is due to the ion $(P—OH)^-$. This is not an ion in the usual sense, since the charge is not due to the protein radical itself, but to a foreign ion. The name *heteroion* is given to such ions. Three conditions may therefore obtain: (*a*) The dispersity increases rapidly with adsorption of OH–, in which case the charge is spread over a large interface, giving lower cond. and higher hydration. The $\sqrt{}$ — OH– adsorbed curve is parabolic. (*b*) The dispersity increases slowly, in which case the cond. is greater and the hydration less. The $\sqrt{}$ — OH– adsorbed curve is hyperbolic. (*c*) Between these extremes the curve approaches a linear function. In a previous paper by Abderhalden and Fodor (*C. A.* 14, 3678) it was shown that the adsorbability of yeast juice protein by charcoal is increased by increasing its dispersity, but diminished by increased hydration. Probably the ability of the protein to absorb other materials is governed by the same factors. The mechanism of fermentation is therefore concluded to be as follows: The ferment colloid plays the part of an adsorbent, binding the substrate. The substrate then reacts with the OH– of the complex in this interfacial layer, which must be regarded as the seat of biological processes. The optimum fermentation is the resultant of two opposite influences, the first the increased dispersity due to increased adsorption of OH–, and the second diminution of the adsorption of the substrate by increased hydration, "In a word, as the essential biological conditions for peptolytic and tryptic fermentation, must be considered the colloids which form heteroions upon which OH ions are carried in a potential condition, provided that their action is not hindered by such great hydration as to diminish the adsorptive powers."

F. L. BROWNE.

The activity of enzymes under abnormal conditions and the alleged aldehyde nature of enzymes. ELIZABETH RONA. *Biochem. Z.* **109**, 279–89 (1920).—When the enzyme pepsin, trypsin, amylase, emulsin, invertase and maltase are caused to exert their activity in the presence of typical substances reacting with the aldehyde group, such as $Na_2S_2O_3$, $NH_2OH.HCl$, Na_2SO_3, KCN, phenylhydrazine and benzenesulf-hydroxamic acid, hydrolysis occurs, provided care is taken to maintain a regular H-ion concn. This is taken as a strong proof against the idea that enzymes exert their activity through the possession of an active aldehyde group. F. S. HAMMETT.

Enzymes. III. Invertase and other enzymes of germinated barley. D. MAESTRINI. *Atti r. accad. Lincei* **28, II**, 509–11 (1919).—Invertase can be exted. from germinated barley dried at temps. below 40° by 0.003 mol. % acetic or hydochloric acid, and is present, not only in the emulsion, but also in the filtrate of the ext. To obtain an active liquid, the extn. should last at least 6 hrs. at 30–35°; the enzyme acts best at about 50° and is destroyed at 55°. The activity

of malt invertase is destroyed in 48 hrs. by 0.003 mol. % KOH. Germinated barley contains a catalase and an oxidase, but no baltase, lactase nor rennase; the ext. does, indeed, coagulate milk, but such coagulation is due to the acidity of the ext., as it is produced even after the latter has been boiled. J. S. C. I.

Chemistry and the food industry. CARL L. ALSBERG. *Chem. Met. Eng.* **23**, 1005–7 (1920).—The application of scientific research to food industries is discussed with special emphasis on the chem. problems of the milling, dairy, sugar and sugar-utilizing industries. A commercial outlet for grain sorghum by the creation of a kafir-corn-products industry is highly desirable. The chemistry involved in the retention of color, flavor and texture in finished preserved products demands attention and much may be accomplished by a study of dehydration. A new type of biochemist must be developed who applies the principles and the technic of biochemical research to the problems of agriculture and the industries using agricultural raw materials. H. A. LEPPER.

The preparation and analysis of a cattle food consisting of hydrolyzed sawdust. E. C. SHERRARD AND G. W. BLANCO. *J. Ind. Eng. Chem.* **13**, 61–5 (1921).—A method for the prepn. of a stock food from white pine sawdust is described. Five complete washings with H_2O equal in wt. to the wood are necessary to remove the H_2SO_4. The sugars were found to leach somewhat slower than the acid and are not appreciably affected by drying the moist product at 75–85° C. Analyses of white pine sawdust and product obtained after digesting with dil. H_2SO_4 under pressure are given and the differences discussed.
H. A. LEPPER.

Notes on lubrication. OWEN LINLEY. *Elec. Times* **58**, 209–11 (1920).—The general theory of lubrication is discussed, and suggestions are given as to the selection and method of using lubricants for steam turbines, Diesel power plants, gearing, line shafting and general machinery. Oil may be tested for solid impurities by spreading a small amt. of the oil on a sheet of clean paper, when, upon holding up to the light, solid particles are easily visible. The presence of acids can be detected by placing a little of the oil on a clean sheet of brass or copper; after a week, the metal will show a green spot if acid is present. Oil can be tested for gumming or oxidation by spreading a film of oil upon a sheet of glass or metal; after a week it should not have lost its greasy feeling, when rubbed with the tips of the fingers. The comparative merit of different oils can be tested, by placing a few drops of each on an inclined metal or glass sheet; the best oil will travel farthest in a given time.
NATHAN VAN PATTEN.

A dust explosion caused by a broken extention light. DAVID J. PRICE. *Millers' Rev.* **39**, 270 (1920).—A serious explosion occurred May 20, 1920, at a large modern elevator in Buffalo, where an extension electric lamp had been lowered into an elevator leg and so covered by wheat that when later an official opened the gate in the leg he failed to observe the lamp. This lamp probably flowed through with the grain into the pit and either the bulb or the wires became broken causing an arc which ignited the explosive air-dust mixt.
CHARLES E. MUNROE.

Colloid-chemical bases of enzyme kinetics. A. FODOR. *Kolloid-Z* **27**, 242–9 (1920).—To visualize the intricacies of enzyme action, it should be treated rather "with mathematics" than "as mathematics". Expts. with a pure enzyme hydrosol prpd. from yeast ext. and capable of splitting polypeptides, indicate that the mols. of the substrate diffuse to the surface of the heterogeneous enzyme phase where it forms an evanescent compound; so that we must consider not only the "remaining quantity" of the substrate, but also its diffusion speed, which in turn depends on its adsorption balance. As Abderhalden and F. have shown (*C. A.* **13**, 2883, 2884) the adsorption isotherm $C_1=K.C_2^{1/n}$ is a special case of the more general formula $C_1=K.C_2$. Where the exponent of C_2 is fractional, the change follows a logarithmic curve, thus stimulating an autocatalytic process. For such systems the term *metakinetic systems* is proposed. In some cases the substrate may absorb the enzyme, which has the effect of making $\sqrt[n]{1}$ in the adsorption formula. The splitting of a polypeptide by the negatively charged yeast enzyme is explained on the Ostwald theory of catalyzers. The following definition is suggested: Insofar as concerns physico-chem. relations, enzymes are products of colloidal nature, at present of plant or animal origin, whose activity is conditioned by their colloidal condition, *i. e.*, that of their sols. They form adsorption compds. with their substrates, losing thereby some of their surface energy, which brings about a hydrolytic splitting. The colloid-chem. factors must be considered as well as electrolytic phenomena. J. ALEXANDER.

The significance of the hydrogen-ion concentration for the digestion of proteins by pepsin. JOHN H. NORTHROP. Rockefeller Inst. *J. Gen. Physiology* **3**, 211–27 (1920).—The rate of digestion of proteins by pepsin and the cond. of protein solns. are closely parallel. "If the isoelec. point of a protein is at a lower H-ion concn. than that of another, the cond. and also the rate of digestion of the first protein extends further to the alk. side." For solns. of gelatin, the optimum H-ion concn. for the rate of digestion and degree of ionization is the same. If, to a protein soln. containing the optimum amt. of acid, a salt with the same anion as the acid is added, a depressing effect on the digestion of the protein by pepsin is observed; the same effect is obtained on the addition of an equiv. of acid. These facts support the hypothesis that the detg. factor in the digestion of proteins by pepsin is the amt. of ionized protein present in the soln. Such a hypothesis cannot be extended to all enzymes since in many cases the substrate does not exist in an ionized condition. The equil., however, might be between tautomeric forms of the substrate, only one of which is attacked by the enzyme. Cf. *C. A.* **13**, 2041; **14**, 2346, 2647.

CHAS. H. RICHARDSON.

Ion series and the physical properties of proteins. II. JACQUES LOEB. Rockefeller Inst. *J. Gen. Physiology* **3**, 247–69 (1920); cf. *C. A.* **14**, 3682.—The Hofmeister ion series does not give the correct expression of the relative effect of ions on the swelling of gelatin. Chlorides, bromides and nitrates do not have hydrating effects, nor do acetates, tartrates, citrates and phosphates have dehydrating effects on gelatin. At the same *p*H, the effect on swelling is the same for the following gelatin salts, gelatin chloride, nitrate, trichloroacetate, tartrate, succinate, oxalate, citrate and phosphate, but is considerably less for the sulfate. This is the expectancy on the basis of the combining ratios of the acids with gelatin. Since with weak dibasic acids the anion in combination with gelatin is univalent while with H_2SO_4 it is bivalent, it is concluded that the valency and not the nature of the ion affects the degree of swelling. Expts. with alkalies supported this conclusion. Expts. on the relative soly. of different gelatin salts in alcohol-water solns. show the same influence of valency of the ion in combination with gelatin as observed in swelling. The drop in the curves for swelling, osmotic pressure or viscosity of gelatin which occurs at *p*H 3.3 or slightly less is not due to a reduction in the concn. of ionized protein in the soln. The difference between the phys. properties of gelatin sulfate and gelatin chloride is not due to differences in the degree of ionization of the 2 salts.

CHAS. H. RICHARDSON.

Investigation of the estimation of crude fiber. OTTO NOLTE. *Landw. Versuchsst.* **96**, 325-37 (1920); cf. *C. A.* **14**, 1859.—N. studied the various factors which influence the result of a crude fiber estn., as size of vessel, manner of heating, purity and strength of chemicals, and method used. In comparing the Cross-Bevan, Weender, Mach, and Kalning methods, the first always gave a higher percentage and the last a lower percentage. Little difference was found in the results obtained by the Weender, and mach methods. The high results as obtained by the Cross-Bevan method indicate that some of the cellulose is dissolved in the Weender and Mach processes. It made no material difference whether or not the fats were extd. before the estn. of the crude fiber. Extns. made of hay showed that $(C_2H_5)_2O$, $(CH_3)_2CO$ and $CHCl_3$ were about equally effective. Material, the greater percentage of which passed a 1 mm. sieve, showed about the same fiber content as meal which did not pass a 1 mm. sieve.

F. M. SCHERTZ.

Finely ground flour and bread prepared therefrom. A. HEIDUSCHKA AND J. DEININGER. Würzburg. *Z. Nahr. Genussm.* **40**, 161-91 (1920).—This is mainly a study of the H_2O-sol. constituents in war flours, doughs, and breads with a preliminary study of suitable chem. methods for examg. such products. In the H_2O-sol. matter of flours were found maltose, sucrose, vegetable gums, and erythro- and amylodextrin. Solids, ash constituents, P- and N-containing substances and acidity were detd. upon flours, doughs, and breads, and upon the H_2O-sol. matter in each. The most completely ground flours yielded the largest H_2O-sol. material. The latter was decreased in bread by the use of hot H_2O in making the dough, while cold H_2O had the opposite effect. The larger the ash and N content of a meal the lower was the H_2O-sol. material. The addition of substitutes such as potato meal, did not affect the % of H_2O-sol. material. Enzymatic action caused increases in carbohydrates and P and N compds. The results indicated that leavened bread contains more H_2O-sol. material than baking powder bread or yeast bread. A modification of the *detn. of acidity* was evolved to avoid slow

filtrations and obscured end-points. Twenty g. of bread is rubbed up with H_2O and made up to 200 cc. in a measuring flask, the mixt. allowed to stand 2 hrs. with occasional thorough shaking. After further shaking it is allowed to settle for 10 min., then 50 cc. of the supernatant liquid is pipetted off for titration. L. D. ELLIOTT.

Protein content of wheat. W. F. GERICKE. Univ. Cal. *Science* **52**, 446-7 (1920).—Pot expts. were carried out in triplicate in 2 series in one of which the N was furnished by $NaNO_3$ and in the other by $(NH_4)_2SO_4$. The soil used was poor and notably deficient in N. Fertilizer was added at the rate of 100 lbs. N per acre to the different sets of pots at the time of planting, 17, 33, 48, 72, and 110 days resp. after planting. The yield of grain of a pure strain of Australian wheat was 9.4, 10.6, 21, 19.9, 21.9 and 13.1 g. and the corresponding percentages of protein were 8.6, 9.3, 10.4, 11.8, 13.2, 15.2 resp. The data show an increase of 77% in the protein content of wheat obtained from plants that received N when they were 110 days old over those that received N at the time of planting. The com. grades of wheat changed from No. 2 soft in the first 2 sets of pots to No. 1 hard in the last 2. It appears that low protein in Pacific States wheat is not due to climate but rather to the failure of the soil to furnish enough available N at the right period of growth. L. W. RIGGS.

The distribution of enzymes and proteins in the endosperm of the wheat berry. F. J. MARTIN. Wellcome Tropical Research Lab. *J. Soc. Chem. Ind.* **39**, 327-8T, 348T(1920).—Enzymic activity as shown by the evolution of CO_2 on fermentation, increases from the interior to the exterior of the endosperm, as does also the gluten content. The quality of the gluten deteriorates in the same direction. The tests were made on Barusso Plate wheat.

Report of cereal products. J. A. LECLERC. Bur. of Chem. *J. Assoc. Official Agr. Chem.* **4**, 180-3(1920).—Results by collaborators show that the CaO vacuum method for H_2O in cereals gives results as good as those by the official method of drying in vacuum or H_2 at 100°. Distd. H_2O containing 0.1% NaCl gives the same amt. of gluten as Washington tap H_2O; pure distd. H_2O causes a large loss of gluten. The NaCl soln. is recommended for washing gluten. For sol. carbohydrates, 1% HCl is preferred as the medium of extn. Extn. (cold H2O) for 45 min. at 5° and 10° gave the same results and 1½ hr. extn. at 10° gave considerably higher results. No definite conclusion was drawn on detn. of Cl but results of collaborators were concordant by gasoline or Et_2O extn. The use of a minimum of Ca acetate in ashing gave results remarkably close to those by the official method (cf. *C. A.* **14**, 3283).

H. A. LEPPER.

Insect control of flour mills. E. A. BACK. Bur. Entomology, U. S. Dept. Agr., *Bull.* 872, 1-40(1920).—Detailed directions are given for the control of insect pests in flour and cereal mills by fumigation with HCN, and by use of heat. Neither method injures the mill building or equipment or affects the baking qualities of the flour.

W. H. ROSS.

Saving money by water treatment. P. M. LABACH. *Ry. Age* **17**, 17(1921).—The Chicago, Rock Island, and Pacific R. R. has 54 water-softening plants for waters varying from 11 to 70 gr. per gal. hardness; 18 soda ash only, 24 intermittent, and 12 continuous, at an investment of $305,587. There are 412 sources of water supply, 290 of which furnish water of over 10 gr. per gal. hardness. About 50% of water comes from wells, 25% from streams, 10% from reservoirs, and the rest from lakes. The 117 supplies from streams carry large quantities of silt during part of the year. From Aug. 1919 to 1920, 1,642,510,000 gallons of water were given complete treatment and 311,460,000 gal. partial. Total of 4,560,110 lbs. scale was prevented from going to locomotive boilers at a cost of $97,458. This represents a net saving of $358,552. Diagram of territory covered and prints of two plants are shown.

R. C. BARDWELL.

The organization of research. WILLIAM M. WHEELER. *Science* **53**, 53-67(1921).—It is "important to preserve from organization that sphere in which it adds least to, and is apt to detract most from, our field of self-expression."

E. J. C.

Iodometric studies. I. The determination of iodine by titration with sodium thiosulfate. BOHDAN KOHLER. *Chem. Listy* **14**, 137-40, 195-9(1920).—Intitrating I in an acid medium with $Na_2S_2O_3$ the presence of a large excess I– may cause an indefinite end-point. More than the theoretical amt. of $Na_2S_2O_3$ is required because a portion of the $Na_2S_2O_3$ is used up in a secondary reaction with HI. To limit the concn. of the I– K. recommends the use of KSCN instead of KI as an aid in dissolving the I (cf. Bruhns, *C. A.* **15**, 351). When using this salt a min. acidity of 0.5 *N* is required. The titration of

I with $Na_2S_2O_3$ produces $S_4O_6^=$ quantitatively even in very acid solns. (6 *N* HCl) if the concn. of the I– is kept at a min. If KSCN is used the titration can be conducted in the presence of air since the concn. of I– is so low that the error due to its oxidation may be considered negligible. JOHN M. KRNO.

A new reaction of saccharin. L. THÉVENON. *J. pharm. chim.* **22**, 421-2 (1920).—To a soln. of 0.1 g. saccharin in 25 cc. H_2O add 10 cc. of a soln. of 0.1 g. $NaNO_2$ in 100 cc. H_2O, and 6 drops of 33% H_2SO_4. After a few min., add 0.1 g. *B*-naphthol. An intense red color is produced, which may be taken up by wool or silk. S. W.

The constitution of the polysaccharides. I. The relationship of inulin to fructose. JAMES COLQUHOUN IRVINE AND ETTIE STEWART STEELE. Univ. of St. Andrews. *J. Chem. Soc.* **117**, 1474-89 (1920).—A previous paper (*Biochem. Z.* **22**, 357) has described the general method, used in this paper, of the use of methylation to det. the structure of di- and polysaccharides. I. and S. discuss briefly with references the general methods of detg. the structure of sugars. Results of exptl. work on the structure of inulin are described. Purified and dehydrated inulin, prepd. from dahlia tubers, has the formula $(C_6H_{10}O_5)x$, is white, free from reducing action on Fehling solution, gives not over 0.2% ash on ignition, and is sol. in NaOH, $[a]^{15}/_D$ —34.21° in H_2O. Dimethylinulin, prepd. by treating the NaOH soln. with Me_2SO_4 and purifying, is a brittle solid, sparingly sol. in cold H_2O, sol. to an opalescent soln. in hot H_2O, and reduces $KMnO_4$ rapidly, $[a]^{15}/_D$ —42.1° in $CHCl_3$. Methylation of inulin does not proceed farther with Me_2SO_4. Trimethylinulin, prepd. by further methylation of dimethylinulin with MeI and Ag_2O (2 mols.), is the limit of methylation for inulin; it is a colorless sirup at 10°, mixes freely with EtOH, $CHCl_3$, and acetone, sparingly sol. in Et_2O and H_2O, $[a]^{15}/_D$ 56° in $CHCl_3$, 50.34° in EtOH. On hydrolysis of trimethylinulin with 1% $(CO_2H)_2$, trimethyl-γ-fructore is formed. This compd. is a viscid sirup, reduces $KMnO_4$ and Fehling soln. in the cold, and also NH_3-$AgNO_3$, $[a]^{15}/_D$ 30.51° in H_2O, and 28.18° in EtOH. By treating trimethyl-γ-fructose with HCl in MeOH at 30° for 9 hrs., trimethylmethylfructoside is prepd. This compd., on methylation with MeI (4 mols.) and Ag_2O (2 mols.) gives tetramethyl-γ-methyfructoside in 80% yield, colorless sirup, b_{12} 134–5°, ^nD 1.4471, reduces $KMnO_4$ vigorously, but not Fehling soln., $[a]$ 20.98° in EtOH. This fructoside, on hydrolysis in 0.25% HCl in H_2O, yields tetramethyl-γ-fructose, $[a]^{15}/_D$ 32.9° in H_2O. On the basis of exptl. data, I. and S. conclude that inulin is an aggregate of γ-fructose residues, each ketose mol. having lost two OH groups in the formation of the polysaccharide. Diagrams are given showing the relationship between the compds. prepd., as well as structural formulas for anhydro-γ-fructose. II.

Conversion of cellulose into glucose. JAMES COLQUHOUN IRVINE AND CHARLES WILLIAM SOUTAR. *Ibid* 1489–1500.—Present views regarding the structure of cellulose are not established, the most acceptable being that cellulose is a polyglucose anhydride, which may be interpreted either that the complex is a polymerized $C_6H_{10}O_5$ (derived from hexose by loss of water) or that it is formed by linking of hexose mols. with loss of water. The object of this paper is to show whether glucose is actually the hexose formed by hydrolysis of cellulose, and in what yield. Methods of acid hydrolysis are unsatisfactory. Ost's method (*Chem. Ztg.* **36**, 1099; cf. *C. A.* **7**, 3836) of using Ac_2O as the hydrolytic agent and isolating the acetates of the hexoses is much better. Up to the present, no method has given anywhere near the quant. yield, based on the wt. of sugar actually isolated. The method used in this paper involves hydrolysis and simultaneous formation of the Me glucosides to prevent further destructive action of the hydrolytic agent. Cellulose, cut into small pieces, is treated below 75° with a mixt. of Ac_2O and H_2SO_4 with stirring. The acetylated product is washed and the ppt. and filtrates are simultaneously hydrolyzed and methylated by methods described in detail. 65 g. cellulose gave 66 g. of Me glucoside, m. 125–154°, $[a]$ 114.8° (yield, 85%), this was a mixt of the *a*- and *B*- forms; it could be sepd. by crystg. from MeOH; in which the *B*-form is sol. Glucose was prepd. from the mixed glucosides, m. 145° (yield 60%), and gave glucose phenylosazone, m. 204–5°. I. and S. conclude that cotton cellulose is composed essentially of glucose residues condensed together. It is possible that part of the 15% not converted into Me glucosides might be due to nuclei which form a ketose on hydrolysis, as the method would not show the presence of a ketose. Further work will include an attempt to discover the nature of this 15% loss. J. B. BROWN.

GRANT, JAMES: **Chemistry of Bread-Making.** 3rd Ed. New York: D. Van Nostrand Co. 236 pp. $2. (Cf. *C. A.* **8**, 3605.)

CONSTITUTION OF THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS

PURPOSE

The purpose of this association is to reach by means of research and discussion, agreement in the methods of analysis necessary in the cereal laboratory. The object to be accomplished is the establishment of standard methods of procedure in the analysis of cereal products.

MEMBERSHIP

Section 1. The membership shall be restricted to those male persons having had at least two years of chemical training in some accredited school, and practical experience in cereal chemistry.

Section 2. All applications for membership must be passed upon by a body known as the executive committee, their decision to be final.

Section 3. Honorary members may be elected by a three-fourths majority vote of the members present at a regular meeting. The name of the candidate to be entered by an active member of the association.

Section 4. Application for membership must be made in writing, and shall be indorsed by at least three active members of the association.

AMENDMENT

Amendment to the Constitution, that those male persons having five years experience in laboratory, be admitted as associate members, at a fee of ten dollars each. Their qualifications being deterined by the executive committee. Such members are not to have any active part in the business meetings of the association.

OFFICERS

Section 1. The officers of this association shall be: President, Vice-president, Secreary and Treasurer, Chairman of the Executive Committee, and the Editor. .

Section 2. Election of officers shall be by ballot at general meetings. There must be at least three nominations of active members for each office to make the election valid.

Section 3. Duties of officers:

a. The President shall preside at all meetings and be the official head of the association.

b. The Vice President shall preside at all meetings in the absence of the President, and shall assist him in the duties of the office. He shall also act as business manager for all publications of the association.

c. The Secretary and Treasurer shall keep a record of the minutes of meetings, send out notices to the members and handle all the correspondence of the association. He shall collect all fees and moneys due the association, and pay all bills; such bills to be countersigned by the chairman of the Executive Committee.

d. The President and the Chairman of the Executive Committee shall jointly select three active members of the association to act as an Executive Committee.

e. It shall be the duty of this commitee to investigate the qualifications of all applicants for membership, and to report to the association in general session. The committee shall co-operate with the president in carrying on the business of the association between meetings. It shall be the privilege of the president to vote in the meetings of this committee.

f. In the absence of both the President and the Vice President it shall be the duty of the Chairman of the Executive Committee to occupy the chair.

g. The Editor shall prepare the material for the official organ of the association and turn it over to the business manager for publication.

FEES

Section 1. The application fee shall be five dollars. The fee must accompany the application; the fee to be returned in case the application is rejected or the applicant fails of election.

Section 3. Honorary members shall be exempt from all dues and fees.

Section 4. Assessments may be levied when the current expenses of the association make this necessary. The Treasurer with the consent of the Executive Committee may levy said assessment.

Section 5. Failure on the part of any member to pay his dues or assessments shall be regarded as a resignation.

Section 6. All annual dues must be paid in advance, the membership card constituting a receipt for the same.

AMENDMENT

Amendment to the constitution, raising membership fee from five dollars to ten dollars after June first 1920.

Amendment to the constitution, raising dues in the association from two dollars to five dollars a year.

ELECTIONS AND MEETINGS

Section 1. Meetings shall be held semi-annually at such time and place as may be determined by the Executive Committee.

Section 2. In all general meetings an attendance of at least one-third of the active members of the association shall constitute quorum.

Section 3. The officers shall be elected to serve for a term of one year, or, until a successor is elected.

Section 4. Honorary members shall have the privilege of the floor, but shall have no vote.

AMENDMENTS

Amendments to this constitution may be made at any general meeting; a two-third majority vote of the members present being necessary to carry.

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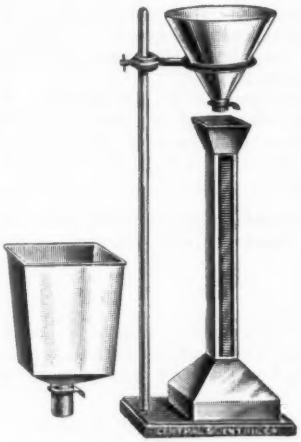

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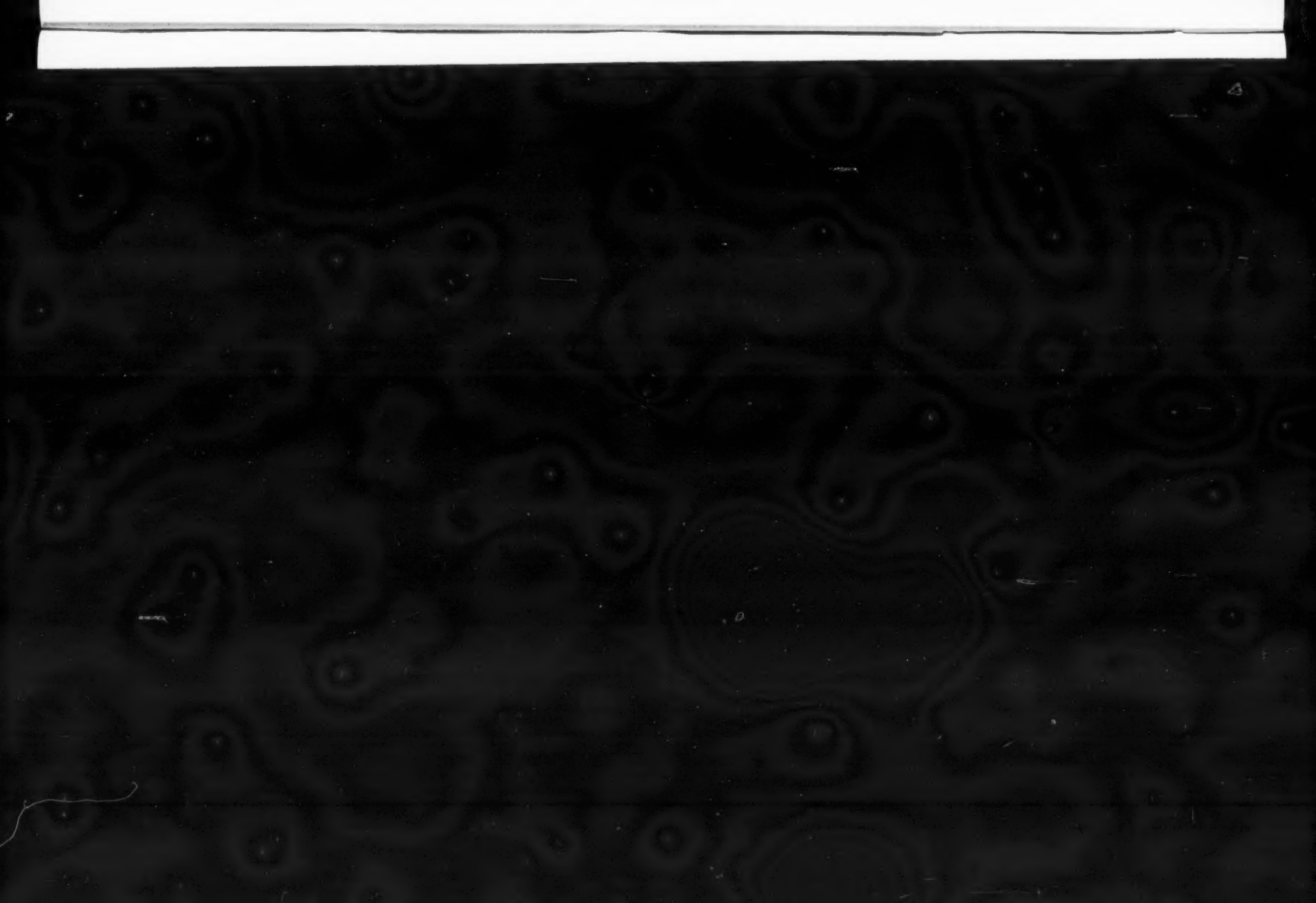

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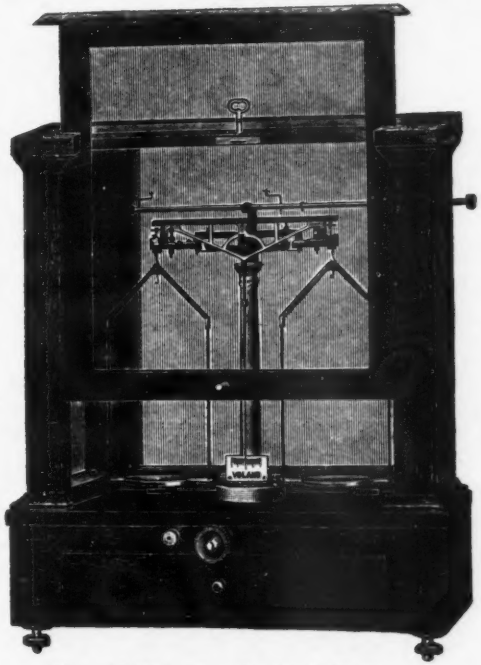

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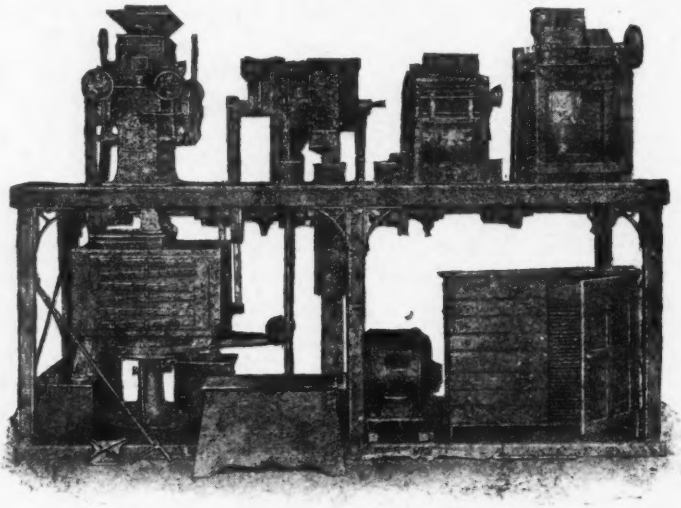

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